# ANNUAL INTEGRATED RESOURCE PLAN PROGRESS REPORT AND FIVE-YEAR PLAN FOR DEPARTMENT OF ENERGY INSTALLATIONS HAVING ALLOCATIONS OF POWER FROM THE WESTERN AREA POWER ADMINISTRATION

**PREPARED FOR**
**U.S. DEPARTMENT OF ENERGY**
**FEDERAL ENERGY MANAGEMENT PROGRAM**

**UNDER CONTRACT NO. DE-AC01-07EE11509**

**TASK ASSIGNMENT NO. 3**

**JULY 2008**

**PREPARED BY**

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# SECTION 1

# INTRODUCTION

## 1. Purpose

On August 16, 1994, the Western Area Power Administration (Western) proposed the Energy Planning and Management Program, requiring nearly all of its customers to prepare Integrated Resource Plans (IRPs). The Program's primary goal is to improve the planning and efficiency of energy use by Western's customers. On October 20, 1995, Western issued its *Final Rule* in the *Federal Register*, which detailed the requirements for IRP submissions to Western.[1] This Progress Report submission, made by the U.S. Department of Energy (DOE) on behalf of the DOE installations receiving Western power allocations, fulfills Western's Annual IRP Progress Report requirements as implemented and set forth in Western's *Final Rule*. The DOE installations represented in this joint submission are: Lawrence Berkeley National Laboratory (LBNL), Lawrence Livermore National Laboratory (LLNL), the LLNL Site 300 installation (Site 300), the Stanford Linear Accelerator Center (SLAC), and the Nevada Test Site (NTS).

In addition to fulfilling Western's Annual IRP Progress Report requirements, the updates prepared for Western will assist in guiding the DOE installations represented in this report to meet their obligations to lower energy usage pursuant to Executive Order 13123 (EO 13123) and the Energy Policy Act of 2005, which require significant decreases in energy usage by federal government agencies. Required reductions in energy usage for DOE facilities were codified further by DOE Order O 430.2B, approved February 27, 2008. Integrated resource planning provides a framework within which customers can plan and implement the least-cost approach to meet power requirements by addressing both supply-side and demand-side resources. This approach serves to accommodate compliance with federal energy usage requirements, and also serves to assist Western in obtaining the information and projections needed for its own planning.

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[1] U.S. Department of Energy, Western Area Power Administration, Final Rule, Title 10, Part 905, Federal Register Notice, October 20, 1995 (revised in the Code of Federal Regulations January 1, 1999, and May 1, 2000).

This report combines the studies Western requires of DOE facilities having entitlements to Western preference power. First, each facility must update previous IRP studies submitted to Western in previous years. The purpose of such updates is to apprise Western of progress made over the previous year and indicate any change in planning that would have a significant impact upon energy usage. Second, Western asks each DOE facility to submit a forward-looking IRP study showing how it plans to utilize supply- and demand-side resources to meet its requirements in the future extending for a minimum of five years, covering the period 2009-2013.0

## 2. Report Organization

This report is divided into seven sections, including this introduction. All of the DOE installations included in this update operate under similar procedural guidelines and are subject to the same set of legislative and regulatory requirements regarding energy conservation and the acquisition of utility services, have access to the same funding sources, and adhere to the same operational guidelines. Section 2 discusses changes in the joint power supply arrangements for the DOE's Northern California laboratories (LBNL, LLNL, Site 300, and SLAC) and describes their current and future supply-side arrangements. Sections 3 through 7 present updated information on an installation-by-installation basis for all the DOE installations receiving Western power allocations. Each section of the report deals with the requirements of the Annual IRP Progress Report, as well as addressing the requirements of the forward-looking IRP.

## 3. Responsible Parties

The responsible party for this report is:

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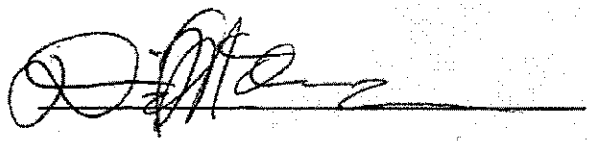
## 4. Approval

I approve the preparation of DOE's IRP Progress Report and Five-Year Plan and its submission to Western.



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# SECTION 2

# JOINT POWER SUPPLY ARRANGEMENTS FOR THE DOE'S NORTHERN CALIFORNIA LABORATORIES

## 1. Introduction

The U. S. Department of Energy continues to plan electric power supply arrangements for LBNL, LLNL, Site 300, and SLAC so as to minimize the combined costs of the four laboratories. (Collectively, the four laboratories are referred to as the DOE's Northern California Laboratories, or the Consortium.) The DOE Office of Science, Berkeley Site Office (DOE/BSO) then re-bills each of the laboratories to accomplish three objectives: (1) recover the total cost of power; (2) allocate these power costs among the four laboratories in a fair and equitable manner; and (3) provide prices to the laboratories that, to the extent practicable, reflect the appropriate marginal costs of capacity and energy to provide the proper price signals for decisions regarding energy conservation and demand-side management.

Effective January 1, 2005, DOE/BSO entered into an Interconnection Agreement with Pacific Gas and Electric Company (PG&E) and several new exhibits to its Intra-Agency Agreement No. 90-SAO-00001 with Western which, together, conferred on the four laboratory sites comprising the Consortium, wholesale status in the bulk power electric market. As such, Western purchases power in the wholesale market on behalf of the Consortium and meets the main load of the four laboratories on a real-time, scheduled, conjunctive basis. Western operates as DOE/BSO's portfolio manager and scheduling coordinator for those loads located in the control area of the California Independent System Operator (CAISO).

The laboratories no longer have independent contract rates of delivery of Central Valley Project (CVP) power. Rather, the Consortium has a 4.5 percent share of the marketed CVP energy. That CVP energy is combined with block power purchases at the California-Oregon border or in Northern California (NP15), and with day-ahead purchases and sales of excess energy in order to match the Consortium's loads with its resources. Western combines most of the appropriate charges (CVP power, other third-party power, and day-ahead purchases) and provides DOE/BSO with one consolidated

bill. It is these consolidated costs that are recovered through DOE/BSO's rebilling rates to each of the laboratories.

## 2. Actual and Projected Energy and Coincident Demands.

Table 2-1 presents actual energy and coincident demand data for the combined loads of the four laboratories comprising the Consortium, which cover the period 2003 through April 2008. Data presented for the May – December 2008 period are estimated. Table 2-2 shows projected energy and coincident demand data for the Consortium.

**Table 2-1**

**U. S. Department of Energy**
**Northern California Consortium**
**Actual Energy and Demand**
**2004 – 2008**
**Energy (mWh)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008* |
|---|---|---|---|---|---|
| January | 68,089 | 48,715 | 74,117 | 68,234 | 82,003 |
| February | 67,882 | 45,197 | 69,058 | 70,850 | 79,150 |
| March | 74,393 | 54,788 | 76,299 | 79,748 | 83,001 |
| April | 72,202 | 67,671 | 77,464 | 75,614 | 60,871 |
| May | 74,742 | 69,857 | 77,567 | 72,493 | 61,309 |
| June | 74,135 | 74,404 | 80,552 | 81,443 | 60,805 |
| July | 78,997 | 80,674 | 85,073 | 87,510 | 63,749 |
| August | 47,021 | 78,905 | 67,886 | 86,133 | 62,180 |
| September | 49,117 | 77,457 | 47,238 | 52,312 | 56,947 |
| October | 52,911 | 61,937 | 49,475 | 52,810 | 58,959 |
| November | 46,558 | 66,126 | 49,847 | 53,534 | 57,431 |
| December | 47,774 | 78,280 | 52,566 | 72,597 | 57,009 |
| **Total** | **753,821** | **804,012** | **807,141** | **853,277** | **783,416** |

**Coincident Demand (kW)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008* |
|---|---|---|---|---|---|
| January | 106,590 | 73,761 | 114,825 | 111,081 | 123,183 |
| February | 109,950 | 75,366 | 117,702 | 121,419 | 123,324 |
| March | 115,674 | 94,014 | 117,045 | 123,915 | 121,557 |
| April | 118,029 | 109,704 | 125,907 | 121,713 | 126,990 |
| May | 119,520 | 118,098 | 126,219 | 123,429 | 96,607 |
| June | 118,626 | 124,302 | 132,045 | 135,072 | 101,086 |
| July | 125,016 | 127,224 | 134,067 | 135,495 | 101,785 |
| August | 81,156 | 127,425 | 129,693 | 133,941 | 100,689 |
| September | 84,900 | 127,461 | 82,947 | 119,499 | 93,189 |
| October | 94,944 | 125,829 | 82,947 | 95,451 | 94,636 |
| November | 73,119 | 115,053 | 78,921 | 85,737 | 95,999 |
| December | 73,512 | 117,891 | 81,096 | 114,222 | 92,158 |
| **Total** | **1,221,036** | **1,336,128** | **1,323,414** | **1,420,974** | **1,271,203** |
| **Maximum** | **125,016** | **127,461** | **134,067** | **135,495** | **126,990** |

* January to April data are actual. May to December data are estimated.

**Table 2-2**
**U. S. Department of Energy**
**Northern California Consortium**
**Energy and Demand Projections**
**2009 - 2013**
**Energy (mWh)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 62,092 | 66,487 | 75,600 | 82,883 | 83,098 |
| February | 58,361 | 62,844 | 71,959 | 78,561 | 78,752 |
| March | 60,652 | 65,518 | 82,079 | 83,002 | 83,203 |
| April | 61,865 | 68,585 | 79,679 | 80,437 | 80,633 |
| May | 64,875 | 71,842 | 78,369 | 79,385 | 79,745 |
| June | 64,246 | 66,086 | 77,378 | 78,321 | 78,672 |
| July | 67,341 | 69,233 | 81,003 | 82,097 | 82,462 |
| August | 58,371 | 60,162 | 72,012 | 73,033 | 73,399 |
| September | 56,598 | 58,248 | 69,770 | 70,734 | 71,088 |
| October | 67,819 | 70,115 | 82,149 | 83,010 | 83,381 |
| November | 63,407 | 65,746 | 77,348 | 78,192 | 78,547 |
| December | 60,413 | 67,626 | 74,606 | 75,433 | 75,770 |
| **Total** | **746,042** | **792,494** | **921,954** | **945,090** | **948,752** |

**Coincident Demand (kW)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 92,406 | 101,118 | 116,912 | 128,250 | 128,540 |
| February | 94,016 | 102,702 | 118,497 | 129,834 | 130,125 |
| March | 96,831 | 105,561 | 130,561 | 132,790 | 133,080 |
| April | 101,555 | 113,290 | 129,957 | 131,216 | 131,507 |
| May | 104,370 | 115,815 | 124,439 | 126,668 | 127,346 |
| June | 109,418 | 112,904 | 130,152 | 132,090 | 132,769 |
| July | 110,113 | 113,789 | 131,231 | 132,879 | 133,460 |
| August | 95,221 | 99,347 | 117,080 | 118,824 | 119,502 |
| September | 94,437 | 98,301 | 116,325 | 117,778 | 118,457 |
| October | 108,910 | 112,718 | 131,032 | 132,195 | 132,873 |
| November | 105,160 | 109,184 | 127,402 | 128,564 | 129,243 |
| December | 100,911 | 111,796 | 122,842 | 124,005 | 124,683 |
| **Total** | **1,213,346** | **1,296,526** | **1,496,430** | **1,535,093** | **1,541,586** |
| **Maximum** | **110,113** | **115,815** | **131,231** | **132,879** | **133,460** |

## 3. Current and Projected Supply-Side Power Supply Resources.

During 2008, the Consortium contracted for 75 MW from the Pacific Northwest with power delivered at the California Oregon Border (COB). That power is then delivered to Western's Tracy Substation, where it is delivered to each of the laboratories over the transmission grid under the control of the California Independent System Operator (ISO), or to Livermore over Western's Tracy tie-line. In addition, during 2008, the Consortium purchased an additional 25 MW during the first quarter of the year in Northern California (referred to as NP15) and an additional 10 MW in April 2008. Because unexpected budgetary cutbacks forced the early termination of a major experiment at the Stanford Linear Accelerator Center (SLAC), the Consortium also sold 35 MW of power that was excess to their needs during the second and third quarters of 2008.

During 2009, the Consortium has contracted for the delivery of 50 MW at COB and is considering the extent to which additional purchases must be made to meet its energy and demand requirements. The Consortium has also purchased 25 MW at COB to meet a portion of their needs for 2010. The Consortium has adopted a risk management protocol to determine how it can best minimize the impact on supply-side resource costs of the volatility of market. Beyond this, the Consortium purchased 26,500 mWh of renewable energy certificates (RECs). Purchases of additional RECs may be required in the future. As some of the details set out in the sections of individual laboratories shows, the laboratories are considering and evaluating other renewable energy resources as well.

Table 2-3 summarizes the Consortium's risk management and procurement strategy for the next several years.

# Table 2-3

## Summary of the Consortium's Risk Management and Procurement Strategy

- Purchase substantially all of the Consortium's projected energy requirements for the first two forward years with fixed price forward purchases
  - Minimizes the Consortium's exposure to price volatility and maximizes the predictability of costs for two years forward
- Utilize the Consortium's transmission entitlement to buy relatively lower cost energy at COB
- Gradually reduce the level of fixed price forward purchases in years three and four; to illustrate
  - 2008: 75 MW at COB; various NP-15 purchases; CVP energy
  - 2009: 75 MW at COB; various NP-15 purchases; CVP energy
  - 2010: 50 MW at COB; CVP energy
  - 2011: 25 MW at COB; CVP energy
  - 2012: CVP energy

# SECTION 3

# LAWRENCE BERKELEY NATIONAL LABORATORY

## 1. Introduction

During FY2007 and for the next several years, the Lawrence Berkeley National Laboratory (LBNL) receives all of its electricity from the Western Area Power Administration (Western). Some of this electricity is from a share of the Consortium's entitlement to Central Valley Project (CVP) power marketed by Western. The balance of LBNL's resources is from a share of third party contracts Western secured acting as an agent for the Consortium. Electricity is delivered to LBNL over the high-voltage transmission grid under the control of the California Independent System Operator (ISO). Separately, Pacific Gas and Electric Company (PG&E) supplies electricity to a number of leased spaces on the site. This report focuses upon current and future demand-side activities at LBNL to fulfill the requirements necessary for the laboratory to continue receiving Western power.

The balance of this section is organized as follows. Subsection 2 below presents actual and projected demand and energy data for LBNL. Subsection 3 shows actual demand-side management (DSM) and conservation projects undertaken by LBNL during the past several years, identifies the reduction in energy intensity, energy and cost savings arising from such projects pursuant to DOE directives. Subsection 4 identifies DSM and other energy conservation projects under consideration that are to be implemented over the next few years and identifies the energy savings resulting from such projects.

Table 3-1 summarizes LBNL's energy usage and peak demand during the FY2003 – FY2007 period. In addition, Table 3-1 shows the laboratory's cost of electricity during this time period.

**Table 3-1**

**LAWRENCE BERKELEY NATIONAL LABORATORY**
**Berkeley, California**

| Data Summary | | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|---|---|
| Building Energy (mWh) | (1) | 64,334 | 78,077 | 70,537 | 60,615 | 60,176 |
| Excluded Energy (mWh) | (2) | 25,031 | 14,619 | 16,725 | 34,331 | 41,913 |
| Renewable Energy Credits (RECs) | (3) | 0 | 0 | 2,374 | 2,848 | 3,157 |
| Peak Demand (kW) | | 12,312 | 11,304 | 11,232 | 11,159 | 11,961 |
| Electricity Expenditures ($K) | | $5,116 | $6,189 | $7,817 | $9,424 | $10,554 |

1. Corrections were made to some of the previously reported values.
2. Process energy use exclusions from energy intensity reduction goal reporting are provided above. Previous IRP Reports have not listed this "excluded' energy use.
3. LBNL and other San Francisco Bay Area DOE facilities entered into an agreement to purchase RECs from WAPA. RECs are subtracted from building energy use to help reduce energy use intensity towards reduction goals. The agreement to purchase RECs expires at the end of 2010. RECs are being phased out for the purpose of reducing energy use intensity, scheduled at 20% each year, starting in FY 2008, until exhausted. REC purchases may still be used to satisfy renewable energy goals.

## 2. Actual and Forecast Demands and Energy

Table 3-2 shows LBNL's actual demand and energy during the period 2004 – April 2008. (Estimated demand and energy data are included for the May – December 2008 period.) Table 3-3 shows LBNL's projected demand and energy during the 2009 – 2013 period.

**Table 3-2**

**U. S. Department of Energy**
**Northern California Consortium**
**Lawrence Berkeley National Laboratory**
**Actual Energy and Demand**
**2004 - 2008**

**Energy (mWh)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008* |
|---|---|---|---|---|---|
| January | 5,579 | 5,845 | 5,993 | 6,442 | 6,467 |
| February | 5,742 | 5,676 | 5,933 | 5,748 | 6,301 |
| March | 6,487 | 6,414 | 6,723 | 6,524 | 6,706 |
| April | 5,935 | 5,338 | 6,479 | 6,391 | 6,198 |
| May | 4,886 | 5,878 | 6,492 | 5,971 | 6,301 |
| June | 6,148 | 6,263 | 6,585 | 6,126 | 5,894 |
| July | 6,355 | 6,412 | 6,848 | 6,488 | 6,606 |
| August | 6,148 | 6,265 | 6,375 | 7,026 | 6,686 |
| September | 6,263 | 6,170 | 6,374 | 6,567 | 5,901 |
| October | 6,398 | 6,358 | 6,044 | 6,863 | 7,188 |
| November | 5,896 | 5,990 | 5,216 | 6,426 | 6,043 |
| December | 5,828 | 5,780 | 5,395 | 6,072 | 3,884 |
| **Total** | 71,666 | 72,388 | 74,456 | 76,645 | 74,175 |

**Demand (kW)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008* |
|---|---|---|---|---|---|
| January | 11,232 | 10,440 | 10,584 | 10,620 | 10,908 |
| February | 10,296 | 10,872 | 10,764 | 10,656 | 10,944 |
| March | 11,376 | 11,016 | 10,620 | 10,908 | 10,980 |
| April | 10,656 | 10,188 | 11,088 | 11,196 | 10,584 |
| May | 9,144 | 10,908 | 11,196 | 11,232 | 11,600 |
| June | 10,656 | 10,728 | 12,600 | 11,448 | 11,600 |
| July | 11,304 | 11,232 | 12,456 | 11,628 | 11,600 |
| August | 11,232 | 11,160 | 11,556 | 12,168 | 11,700 |
| September | 11,520 | 11,484 | 11,340 | 11,808 | 11,800 |
| October | 11,664 | 11,016 | 10,836 | 11,916 | 11,700 |
| November | 10,512 | 10,764 | 9,719 | 11,124 | 11,800 |
| December | 10,512 | 10,440 | 9,864 | 11,016 | 11,700 |
| **Total** | **130,104** | **130,248** | **132,623** | **135,720** | **136,916** |
| **Maximum** | **11,664** | **11,484** | **12,600** | **12,168** | **11,800** |

* January – April are actual data; May – December are projected.

**Table 3-3**

**U. S. Department of Energy**
**Northern California Consortium**
**Lawrence Berkeley National Laboratory**
**Energy and Demand Projections**
**2009 - 2013**

**Energy (mWh)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 7,870 | 8,893 | 14,006 | 21,289 | 21,504 |
| February | 6,701 | 7,623 | 12,238 | 18,840 | 19,031 |
| March | 6,511 | 7,506 | 18,967 | 19,890 | 20,091 |
| April | 6,574 | 7,537 | 18,631 | 19,389 | 19,585 |
| May | 7,094 | 8,084 | 19,711 | 20,727 | 21,087 |
| June | 6,658 | 7,617 | 18,909 | 19,852 | 20,203 |
| July | 7,403 | 8,397 | 20,167 | 21,261 | 21,626 |
| August | 7,484 | 8,478 | 20,328 | 21,349 | 21,715 |
| September | 6,666 | 7,625 | 19,147 | 20,111 | 20,465 |
| October | 8,072 | 8,992 | 21,026 | 21,887 | 22,258 |
| November | 6,890 | 7,771 | 19,373 | 20,217 | 20,572 |
| December | 4,726 | 10,635 | 17,615 | 18,442 | 18,779 |
| **Total** | **82,649** | **99,158** | **220,118** | **243,254** | **246,916** |

**Demand (kW)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 13,000 | 15,000 | 22,700 | 34,400 | 34,700 |
| February | 13,100 | 15,000 | 22,700 | 34,400 | 34,700 |
| March | 13,100 | 15,000 | 32,200 | 34,500 | 34,800 |
| April | 13,200 | 15,000 | 32,200 | 33,500 | 33,800 |
| May | 13,300 | 15,000 | 32,500 | 34,800 | 35,500 |
| June | 13,300 | 15,000 | 32,800 | 34,800 | 35,500 |
| July | 13,300 | 15,000 | 33,000 | 34,700 | 35,300 |
| August | 13,400 | 15,100 | 33,400 | 35,200 | 35,900 |
| September | 13,500 | 15,200 | 33,800 | 35,300 | 36,000 |
| October | 13,500 | 15,100 | 34,000 | 35,200 | 35,900 |
| November | 13,600 | 15,200 | 34,000 | 35,200 | 35,900 |
| December | 13,500 | 22,600 | 34,000 | 35,200 | 35,900 |
| **Total** | **159,800** | **188,200** | **377,300** | **417,200** | **423,900** |
| **Maximum** | **13,600** | **22,600** | **34,000** | **35,300** | **36,000** |

## 3. Current DSM / Conservation Efforts

In the 1999 Integrated Resource Plan (IRP), the LBNL set goals to meet the updated requirements of Executive Order 13123 (issued June 1999); reduction in the site's total energy usage per square foot by 20 percent by FY 2005 and 25 percent by FY 2010, relative to a FY 1990 baseline. The laboratory achieved these goals through the energy efficiency measures and retrofit projects that were completed by FY 1999.

The 1999 energy reduction goals were recently superseded and updated by the Energy Policy Act of 2005 (August 8, 2005), Executive Order 13423 (January 26, 2007), and the Energy Independence and Security Act of 2007 (December 19, 2007), culminating with signing of the updated Department of Energy Order 430.2B Departmental Energy, Renewable Energy and Transportation Management on January 27, 2008. Energy usage intensity reduction goals have been increased to 3 percent per year, starting in FY 2006, for a total 30 percent reduction by the end of FY 2015, with a revised baseline of FY 2003.

Table 3-4 summarizes total annual energy consumption, by type, renewable energy credit (REC) purchases, building floor areas and a comparison of energy use intensity savings achieved to the goals. This table includes all LBNL energy usage and building areas. The results in Table 3-4 show that LBNL had reduced energy use intensity by over 8 percent at the end of FY 2007 from the updated FY 2003 baseline. To achieve these savings, LBNL implemented the energy efficiency projects listed on Table 3-5, below. Planning to achieve the FY 2015 goal involves implementation of an energy savings performance Contract (ESPC), which is currently under development.

## Table 3-4

## LBNL Performance towards DOE O 430.2B Energy Use Intensity Reduction Goals

| Data Summary | | FY 2003 | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|---|---|---|
| Buildings Power Use | (mWh) | 64,334 | 78,077 | 70,537 | 60,615 | 60,176 |
| RECs | (mWh)[1] | 0 | 0 | 2,374 | 2,848 | 3,157 |
| Buildings Nat Gas Use | (MCF) | 161,193 | 156,171 | 146,760 | 150,933 | 148,710 |
| Building Energy Use | (B BTU)[2] | 385.698 | 427.411 | 383.822 | 352.713 | 350.025 |
| Buildings Floor Area | (K-GSF) | 2,046 | 1,972 | 2,036 | 2,096 | 2,020 |
| Excluded Floor Area | (K-GSF)[3] | 43 | 41 | 41 | 284 | 41 |
| Total Floor Area | (K-GSF) | 2,089 | 2,013 | 2,077 | 2,380 | 2,061 |
| Excluded Power Use | (mWh)[3] | 25,031 | 14,619 | 16,725 | 34,331 | 41,913 |
| Total Electric Power | (mWh) | 89,366 | 92,697 | 87,262 | 94,947 | 102,089 |
| Energy Use Intensity | (K-BTU / GSF) | 188.528 | 216.700 | 188.493 | 168.259 | 173.283 |
| Savings from FY 2003 Baseline | | N/A | (14.9%) | 0.02% | 10.75% | 8.1% |
| DOE O 430.2B Savings Goals[4] | | N/A | N/A | N/A | 3.0% | 6.0% |

Notes:

1. LBNL and other San Francisco Bay Area DOE facilities entered into an agreement to purchase Renewable Energy Credits (RECs) from WAPA. RECs are subtracted from building energy use to help reduce energy use intensity towards reduction goals. RECs are being phased out for the purpose of reducing energy use intensity, scheduled at 20% each year, starting in FY 2008, until exhausted. REC purchases may still be used to satisfy site renewable energy goals.
2. Total energy use is determined by converting electric power and natural gas to the common units per conversion factors: 3,412 BTU/kWh and 1,031 BTU/CF, respectively.

   Criteria allow process energy uses and building areas to be excluded from energy use intensity savings determinations. Such uses are defined as energy-intensive loads driven by mission and/or operational requirements that are not influenced by conventional building energy conservation measures. Annual self-certification is required.
3. Energy use intensity savings goals of DOE O 430.2B originated in EO 13423 and require savings of 3% per year, starting in FY 2006 to achieve a total savings of 30% by the end of FY 2015. FY 2003 has been established as the "Baseline" year.

## TABLE 3-5

## LAWRENCE BERKELEY NATIONAL LABORATORY

## FY 1997 THROUGH 2007 PROJECT SUMMARY DATA

| Project | Completion Date | Cost ($, 000) | Annual Savings[1] (mWh) | Annual Savings[1] ($, 000) |
|---|---|---|---|---|
| Motor Replacements | Dec. 1996 | 507 | 120 | 7.4 |
| Group II EMCS Upgrade | Mar. 1997 | 1,100 | 2,270 | 140.4 |
| Energy Upgrades – Bldgs. 54, 72, & 76 | Jul. 1997 | 912 | 185 | 11.4 |
| Bldg. 62 Retrofits | Sep. 1997 | 342 | 440 | 27.2 |
| Total FY 1997 | | $2,861 | 3,015 | $186.4 |
| Packaged HVAC | Dec. 1997 | 211 | 450 | 27.8 |
| Bldg. 6 Lighting Upgrade | Jul. 1998 | 75 | 200 | 12.4 |
| Process Loads | Jul. 1998 | 226 | 565 | 34.9 |
| Small Fan Control | Aug. 1998 | 116 | 111 | 6.9 |
| New Lighting Technologies | Aug. 1998 | 160 | 530 | 32.8 |
| **Total FY 1998** | | **$788** | **1,856** | **$114.8** |

| Project | Completion Date | Cost ($, 000) | Annual Savings[1] (mWh) | Annual Savings[1] ($, 000) |
|---|---|---|---|---|
| Bldg. 2 Chiller Turbomodulator | Jul. 1999 | 75 | 200 | 12.4 |
| Cooling Towers | Sep. 1999 | 209 | 580 | 35.9 |
| Bldg. 70 HVAC Zone Controls | Sep. 1999 | 50 | 165 | 10.2 |
| Bldg. 34 Chiller & Cooling Tower | Sep. 1999 | 750 | 400 | 24.7 |
| **Total FY 1999** | | **$1,084** | **1,345** | **$83.2** |
| | | ($, 000) | (mWh) | ($, 000) |
| Sealing Ductwork – Bldg 90 | July 2004 | 60 | 210 | 13.0 |
| Total FY 2004 | | $60 | 210 | $13.0 |
| Total FY 2005 | No projects were completed during this year | | | |
| Total FY 2006 | No projects were completed during this year | | | |
| Sealing Ductwork - Bldgs 50 & 70 | June 2007 | 96[2] | 227 | 14.0 |
| Retro Commission B66 3rd Floor | Aug. 2007 | 265[2] | 810 | 50.1 |
| Total FY 2007 | | $541 | 1,210 | $64.1 |
| **Total for FY 1997 through 2007** | | **$5,334** | **7,636** | **$461.5** |

Notes:
1. Annual cost savings are based on an updated Western rate of $61.84 per mWH.
2. Project costs from records of project completion.

The laboratory's prior IRP's included action plans to implement energy conservation and DSM measures to reduce LBNL's energy requirements. The short-term and long-term plans that were completed by FY 2007 have collectively provided annual savings of 7,636 mWh of electricity and about $461,500. All of the DSM and energy efficiency projects, shown on Table 3-4, implemented since FY 1997, are still in operation today; annual energy savings have continued at the previously stated rates for these projects.

Renewable Energy. To date, LBNL has satisfied the renewable energy acquisition goal by purchasing RECs arranged by Western. Western has purchased a total of 26,500 mWh of RECs per year through FY 2010 for the Consortium at a cost of $1.00 per mWh. The RECs are distributed to assure that each of the laboratories achieves the 3 percent renewable energy goal.

## 4. New Projects

An ESPC project is currently being developed with NORESCO under DOE's Super-ESPC program to identify, develop and install measures that will provide compliance with the 30 percent energy use intensity savings goal by the end of FY 2015. Project costs, energy and other related cost savings are summarized on Table 3-6, based on NORESCO's Initial Proposal (IP), submitted, as revised, in November 2007. A detailed energy study is currently underway which will result in submittal of a delivery order proposal scheduled for September 2008. Contract signing is expected in January or February 2009.

**TABLE 3-6**

**LAWRENCE BERKELEY NATIONAL LABORATORY**
**NEW PROJECTS[1]**

| Project | Construction Completion | Implementation Price[2] ($, 000) | Annual Energy & Cost Savings[3] Power (mWh) | NG (MCF) | O&M | Total (B BTU) |
|---|---|---|---|---|---|---|
| ESPC Project | FY 2011 | $11,295 | 8,258<br>$685K | 53,008<br>$476K | -<br>$76K | 82.84<br>$1,236K |
| The ESPC Project IP includes the following Energy Conservation Measures (ECMs): | | | | | | |
| ECM-1 | Controls / R-Cx | $7,938 | 4,427 | 42,866 | $53K | 57.98 |
| ECM-2 | Duct Sealing | $1,104 | 1,373 | 4,846 | - | 9.53 |
| ECM-3 | Fume Hood Tune | $1,667 | 1,628 | 6,940 | - | 12.49 |
| ECM-16 | Lighting | $92 | 830 | 0 | $23K | 2.83 |

Notes:

1. All the above data are estimates from the IP. DES activities are currently underway; it is expected that additional ECMs will be developed and proposed.
2. Implementation Price is the ESPC construction cost, before finance charges.
3. Total energy use is determined by converting electric power and natural gas to the common units per conversion factors: 3,412 BTU/kWh & 1,031 BTU/CF, respectively.

Renewable Energy. LBNL has evaluated renewable energy applications on several occasions over the past years and has not been able to demonstrate a life-cycle cost-effective project. The feasibility of installing on-site renewable energy is being reinvestigated presently, with the assistance of a consultant retained by the DOE's Transformational Energy Action Management (TEAM) Initiative. TEAM consultant findings are expected to be available in early June 2008. Preliminary indications are that there may be a couple feasible projects, particularly a solar hot water system at the cafeteria and a PV installation mounted on the existing racks on the Building 90 roof.

Implementation of these measures will not achieve compliance with the renewable energy percentage goals. Additional renewable energy will be secured, as needed, either by direct purchase of renewable power and/or via the purchase of additional RECs.

Another possibility of achieving the renewable energy goals for all three SF Bay-Area DOE facilities is to locate a large PV system at the LLNL site, with participation from LBNL and SLAC. Execution of this effort could provide a PV installation with generating capacity of 15 to 30-MW. Several hurdles would have to be overcome to implement a joint project of this nature. The first would require DOE to accept a joint project at one of the laboratories with the other two laboratories also receiving credit for on-site renewable power generation. Next, the laboratories would have to reach a collaborative agreement to share construction support costs. Most important, the economics of the proposed installation would have to improve significantly from the current tentative 19-year simple payback period determined by the TEAM consultant.

Measurement Strategies. Almost all LBNL buildings are metered for electric power and natural gas consumption. In many cases, sub-meters are installed to measure the energy consumption and demand of specific processes. Metered energy consumption is, thus, used to verify savings of individual measures. Trend data from

newly installed heating, ventilation and air-conditioning (HVAC) direct digital controls (DDC) will be used to measure and verify energy savings from any ESPC project.

Impact of Projected Electric Energy Conservation Measures. Projections of LBNL on-site electric energy consumption through FY 2014 are provided on Table 3-7. This shows the impact of conservation measures currently planned under the ESPC in Table 3-6. No ESPC demand savings are currently projected.

Other Energy Efficiency Measures and Policies at LBNL. DOE uses employee incentive programs to recognize outstanding contributions toward energy and dollar savings at DOE facilities and field organizations. Awards are presented to recognize outstanding contributions toward increased energy efficiency within the DOE complex, and draw attention to energy efficiency efforts, as mandated by the Energy Policy Act of 2005, Executive Order 13423 and by DOE O 430.2B.

**TABLE 3-7**
**LAWRENCE BERKELEY NATIONAL LABORATORY**
**ENERGY PROJECTIONS (WESTERN POWER)**
**(mWh)**

| Federal Fiscal Year | Base Case Energy Projections | Cumulative Estimated Savings[2] | Net Energy Requirements[3] |
|---|---|---|---|
| 2003[1] | 74,400 | Included | 74,400 |
| 2007[1] | 69,500 | Included | 69,500 |
| 2008 | 73,000 | 0 | 73,000 |
| 2009 | 80,987 | 365 | 80,622 |
| 2010 | 95,800 | 4,352 | 91,448 |
| 2011 | 197,541 | 8,039 | 189,502 |
| 2012 | 248,980 | 8,258 | 240,722 |
| 2013 | 254,110 | 8,258 | 245,852 |
| 2014 | 255,174 | 8,258 | 246,916 |

Notes:

1. FY 2003 & FY 2007 values are actual, including the effects of previously implemented energy savings projects.
2. The only future energy savings effort planned at this time is the Energy Savings Performance Contract. (Refer to Table 3-5.) Savings are indicated based on the revised ESPC Initial Proposal dated 14-Nov-2007. The final project, when implemented is expected to include additional measures, increasing the savings.
3. This summary does not include off-site facilities which receive power from PG&E.

# SECTION 4

# LAWRENCE LIVERMORE NATIONAL LABORATORY

## 1. Introduction

The Lawrence Livermore National Laboratory (LLNL) is a renowned applied science facility that is part of the National Nuclear Security Administration (NNSA) within the Department of Energy. Located near Livermore, California, as a national security laboratory, LLNL is responsible for ensuring that the nation's nuclear weapons remain safe, secure, and reliable through the application of advances in science and engineering.

LLNL receives all of its electricity under arrangements between DOE's Berkeley Site Office and Western. A portion of this power is from the Consortium's entitlement to CVP power marketed by Western. The balance of LLNL's resources is from a share of third party contracts Western secured acting as an agent for the Consortium. Power is delivered to LLNL over a Western-owned 230 kilovolt transmission line between Western's Tracy Substation and the Livermore Substation. This section of the report focuses on LLNL's demand-side activities, since supply-side resources are secured under the auspices of the Berkeley Site Office acting on behalf of all of DOE's Northern California Laboratories. We also discuss LLNL's work in securing renewable resources to meet its future requirements.

Table 4-1 summarizes Livermore's demand and energy usage during the FY 2005 – FY 2008 period. Estimated expenditures of electricity are also presented.

**Table 4-1**

**Lawrence Livermore National Laboratory**
**Livermore, California**

| Data Summary | FY 2005 | FY 2007 | FY 2008 |
|---|---|---|---|
| Total Energy (mWh)* | 337,421 | 379,228 | 383,264 |
| Peak Demand (kW) | 60,660 | 63,180 | 60,912 |
| Electricity Expenditures | $16,104,614 | $18,075,963 | $20,132,608 |

* LLNL Total Energy (mWh) data is limited to electric power provided by Western for the federal fiscal years, commencing in October, each year.

The remainder of this section is organized as follows: Section 2 presents actual (2004 – April 2008) and forecasted (May 2008 – 2013) demand and energy data. Section 3 reports the results of current demand-side conservation and energy efficiency measures in place at LLNL and their impact on energy and power cost. Section 4 identifies demand-side measures to be considered to comply with DOE's requirements for reductions in energy usage in the future.

## 2. Actual and Forecast Demands and Energy

Table 4-2 shows LLNL's actual demand and energy during the period 2004 – April 2008. (Demand and energy data for the May – December 2008 period are estimated.) Table 4-3 shows LLNL's projected demand and energy during the 2009 – 2013 period.

## Table 4-2

## U. S. Department of Energy
## Northern California Consortium
## Lawrence Livermore National Laboratory
## Actual Energy and Demand
## 2004 - 2008

### Energy (mWh)

| Month | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| January | 28,374 | 29,906 | 34,181 | 34,660 | 34,754 |
| February | 27,096 | 27,061 | 31,123 | 31,305 | 32,835 |
| March | 30,002 | 30,481 | 34,188 | 34,732 | 34,826 |
| April | 29,280 | 29,484 | 32,965 | 33,594 | 33,737 |
| May | 30,991 | 31,759 | 35,470 | 35,429 | 36,137 |
| June | 30,975 | 31,874 | 35,825 | 35,221 | 36,539 |
| July | 32,920 | 35,825 | 38,254 | 37,516 | 38,266 |
| August | 33,326 | 35,862 | 35,886 | 37,326 | 38,072 |
| September | 31,659 | 33,967 | 34,441 | 35,325 | 37,438 |
| October | 30,919 | 35,806 | 34,478 | 35,760 | 38,222 |
| November | 28,880 | 33,415 | 33,077 | 34,303 | 33,738 |
| December | 29,601 | 33,969 | 34,038 | 34,442 | 34,718 |
| **Total** | **364,022** | **389,408** | **413,925** | **419,612** | **429,284** |

### Demand (kW)

| Month | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| January | 43,704 | 46,296 | 50,364 | 51,372 | 51,048 |
| February | 45,576 | 45,504 | 52,344 | 52,056 | 51,948 |
| March | 51,552 | 49,788 | 52,056 | 56,628 | 52,344 |
| April | 54,360 | 48,780 | 55,800 | 55,332 | 53,892 |
| May | 54,792 | 55,944 | 59,544 | 58,680 | 60,832 |
| June | 60,912 | 58,356 | 62,100 | 62,424 | 65,213 |
| July | 56,160 | 60,264 | 65,304 | 61,632 | 66,073 |
| August | 56,952 | 59,256 | 59,796 | 63,864 | 64,776 |
| September | 57,384 | 60,480 | 60,588 | 60,804 | 64,192 |
| October | 53,280 | 58,572 | 60,588 | 56,772 | 64,218 |
| November | 46,008 | 54,432 | 56,376 | 54,720 | 59,739 |
| December | 45,864 | 51,696 | 51,696 | 51,696 | 55,692 |
| **Total** | **626,544** | **649,368** | **686,556** | **685,980** | **709,966** |
| **Maximum** | **60,912** | **60,480** | **65,304** | **63,864** | **66,073** |

## Table 4-3

## U. S. Department of Energy
## Northern California Consortium
## Lawrence Livermore National Laboratory
## Energy and Demand Projections
## 2009 - 2013

**Energy (mWh)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 35,706 | 36,064 | 36,064 | 36,064 | 36,064 |
| February | 34,788 | 35,136 | 35,136 | 35,136 | 35,136 |
| March | 35,781 | 36,138 | 36,138 | 36,138 | 36,138 |
| April | 34,609 | 34,955 | 34,955 | 34,955 | 34,955 |
| May | 36,499 | 36,864 | 36,864 | 36,864 | 36,864 |
| June | 36,905 | 37,274 | 37,274 | 37,274 | 37,274 |
| July | 38,649 | 39,035 | 39,035 | 39,035 | 39,035 |
| August | 38,453 | 38,838 | 38,838 | 38,838 | 38,838 |
| September | 37,812 | 38,190 | 38,190 | 38,190 | 38,190 |
| October | 39,587 | 40,951 | 40,951 | 40,951 | 40,951 |
| November | 35,856 | 37,512 | 37,512 | 37,512 | 37,512 |
| December | 35,266 | 36,556 | 36,556 | 36,556 | 36,556 |
| **Total** | **439,909** | **447,512** | **447,512** | **447,512** | **447,512** |

**Demand (kW)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 54,609 | 56,487 | 56,487 | 56,487 | 56,487 |
| February | 56,071 | 58,108 | 58,108 | 58,108 | 58,108 |
| March | 59,196 | 61,188 | 61,188 | 61,188 | 61,188 |
| April | 58,914 | 60,588 | 60,588 | 60,588 | 60,588 |
| May | 62,241 | 63,649 | 63,649 | 63,649 | 63,649 |
| June | 67,086 | 68,960 | 68,960 | 68,960 | 68,960 |
| July | 68,072 | 70,071 | 70,071 | 70,071 | 70,071 |
| August | 66,737 | 68,699 | 68,699 | 68,699 | 68,699 |
| September | 65,981 | 67,770 | 67,770 | 67,770 | 67,770 |
| October | 66,510 | 68,802 | 68,802 | 68,802 | 68,802 |
| November | 62,249 | 64,759 | 64,759 | 64,759 | 64,759 |
| December | 57,806 | 59,919 | 59,919 | 59,919 | 59,919 |
| **Total** | **745,471** | **769,000** | **769,000** | **769,000** | **769,000** |
| **Maximum** | **68,072** | **70,071** | **70,071** | **70,071** | **70,071** |

## 3. Current DSM Projects

For the past several years, LLNL has implemented numerous demand-side programs. The results in Table 4-4 show that programs implemented from FY 1997 through FY 2005 have produced annual energy savings of 17,900 mWh, reducing LLNL's power costs by $1.4 million. The energy savings identified in Table 4-3 continue to be realized by the laboratory.

**Table 4-4**

**Lawrence Livermore National Laboratory**
**FY 1997 through 2005 Actual Project**
**Summary Data Updates from 2004 IRP**

| Project | Date of Completion | Cost ($, 000) | Annual Savings[2] mWh | ($, 000) |
|---|---|---|---|---|
| Occupancy Sensors - Phase 2 | Dec-1996 | $116.0 | 620 | $31.9 |
| High Efficiency Lighting - Phase 5 | Jan-1997 | $1,129.0 | 3,820 | $196.8 |
| High Efficiency Lighting - Phase 6 | May-1997 | $822.0 | 2,697 | $138.9 |
| **Total FY 1997** | | **$2,067.0** | **7,137** | **$367.6** |
| High Efficiency Lighting - Phase 5A | Jun-1998 | $361.0 | 361 | $18.6 |
| Off Hours Direct Digital Control | Sep-1998 | $307.0 | 307 | $15.8 |
| **Total FY 1998** | | **$668.0** | **668** | **$34.4** |
| Install HVAC Energy Management System – B381[1] | Sep-1999 | $240.9 | 1,776 | $273.8 |
| HVAC Modifications (Various Buildings)[1] | Sep-1999 | $48.9 | 701 | $72.1 |
| **Total FY 1999** | | **$289.8** | **2,477** | **$346.0** |
| Chiller Condenser Water Temperature Reset | Oct-1999 | $73.1 | 1,056 | $54.4 |
| B543 Restore Solar Domestic Hot Water System | Oct-1999 | $10.9 | 12.5 | $0.6 |
| Compressed Air Distribution System Leak Repairs | Oct-1999 | $21.1 | 887 | $45.7 |
| Upgrade HVAC Energy Management System - B131[1] | Feb-2000 | $170.5 | 775 | $76.3 |
| EXPAT Demo: Use P&T effluent in bldg heat pumps | Jun-2000 | $33.8 | 72 | $5.3 |
| Central Plant Retrofits: Float condensate traps and LCW flow controls | Jul-2000 | $45.0 | 469 | $24.2 |
| Compressed Air System Process Improvement | Sep-2000 | $52.8 | 1,153 | $59.4 |
| **Total FY 2000** | | **$407.1** | **4,424** | **$265.8** |

## Table 4-4 (Cont'd)

| Project | Date of Completion | Cost ($, 000) | Annual Savings[2] mWh | Annual Savings[2] ($,000) |
|---|---|---|---|---|
| High Efficiency Motors 325PLCW – 1 & 12 | Oct-2000 | $14.1 | 31 | $1.6 |
| High Efficiency Motor for LCW Circulation Pump (350 HP) | Nov-2000 | $12.8 | 60 | $3.1 |
| B482W & Part B482S Lighting Retrofit - T-8 Lamps and Delamping[1] | May-2000 | $59.4 | 341 | $20.4 |
| Water and Energy Savings Automatic Urinal Flush Valves[1] | Sep-2001 | $63.5 | 23 | $22.8 |
| Water and Energy Savings Ultra-Low Flow Toilets[1] | Sep-2001 | $52.7 | 15 | $15.1 |
| B482N Lighting Retrofit: New Indirect Fluorescent Fixtures[1] | Sep-2001 | $89.3 | 265 | $17.2 |
| **Total FY 2001** | | **$291.7** | **735** | **$80.2** |
| B241 HVAC DDC Control Retrofit[1] | Sep-02 | $221.1 | 1,077 | $137.2 |
| B291 Compressed Air High Pressure Alarm | Aug-02 | $10.3 | 114 | ($0.1) |
| VendingMizer Installations 85-devices installed in 47 buildings | May-02 | $21.5 | 110 | $5.7 |
| WattStopper Isolé Plug Strips® 2,000 Plug-Load controllers | Jan-02 | $100.0 | 1,049 | $54.0 |
| CA System Leak Survey & Repair UTel/MUD find and repair leaks | Jan-02 | $5.5 | 8.729 | $0.4 |
| Drain-Down Recovery System (2002 Federal Energy Management Award) | May-02 | $14.9 | 0.266 | $61.8 |
| **Total FY 2002** | | **$373.4** | **2,360** | **$259.1** |
| Discovery (Visitors') Center Photovoltaic Demonstration | Apr-03 | $97.5 | 39 | $2.0 |
| T1888/1889 PV Parking Lot & Walkway Lighting[2] | Sep-03 | $133.7 | 15.42 | $0.4 |
| Smart Motor Heater Retrofit at Central Plant U291 | Sep-03 | $4.7 | 30.24 | $1.6 |
| **Total FY 2003** | | **$236.0** | **86** | **$5.9** |
| Waterless Urinal Pilot Program | Dec-04 | $17.2 | 2.63 | $3.9 |
| **Total FY 2005** | | **$17.2** | **2.63** | **$3.9** |
| **Grand Total** | | **$4,350.1** | **17,889** | **$1,360.9** |

1. Dollar savings for these projects include electrical and natural gas savings calculated based on present Western electric power rates (August 2006) and trailing year average natural gas rates (August 2005 through July 2006).
2. 2002 EPA Region – 9 Green Government Award and 2003 DOE Departmental Energy Management Achievement Award

LLNL has completed installation of its new TeraScale Computational Facility (TSF), and achieved significant reductions in load. Computations Directorate personnel took steps to reduce energy use by computer systems from original estimates by 50 percent, cutting electrical energy demand by 7.0 MW. This load reduction is equivalent to 11 percent of the laboratory's peak electrical demand. In these efforts, LLNL worked closely with IBM to encourage a more energy efficient design. Additionally, the facility cooling system, designed to industry norms was expected to use energy equivalent to 70 percent of the computer load. Records show that energy conserving practices like raising the temperature on the computer floors at TSF have resulted in the system using only 30 percent to 40 percent of the computer load without any adverse effects on the system.

## 4. Livermore Energy Savings Goals

LLNL has achieved the FY2005 goal and is on track to meet the 2010 goal. The laboratory's FY 2006 Performance towards EPAct-2005 energy use reduction goals is as follows. During FY2006, LLNL took action to achieve an energy use reduction of 2.0 percent based on consumption during FY 2003, reaching a savings of 1.83 percent, almost meeting this new goal. Baseline and FY 2006 energy use and goal-oriented performance are summarized in Table 4-5 below.

**Table 4-5**

**LLNL FY 2006 Energy Use and Performance to EPAct-2005 Energy Use Reduction Goals**

| Description | FY 2003 | FY 2006 | Savings |
|---|---|---|---|
| Electric Power (mWh) | 321,919 | 307,772 | 4.39% |
| Green Credits (mWH) | 0 | 13,220 | - |
| Fuel Oil (K Gal) | 12.41 | 0 | 100.00% |
| Natural Gas (MCF) | 446,637 | 460,636 | (3.13%) |
| LPG/Propane (K Gal) | 0 | 5.11 | - |
| Equivalent Energy (MBTU) | 1560.6 | 1525.5 | 2.25% |
| Facilities Floor Area (K SF) | 7,024.0 | 6,994.4 | (0.42%) |
| Energy (BTU) / (K SF) | 276.7 | 218.05 | 1.83% |

Measures undertaken to reduce goal-oriented energy use included voluntary employee actions promoted in response to the President's Hurricane Relief Directive and by excluding the extraordinarily high electric power use of the new Terascale Computational Facility, the world's fastest computer system.

Renewable Energy. LLNL has purchased renewable energy credits (RECs) since FY 2005 and has limited self electric power generation capability via a grid-connected photovoltaic exhibit.

1. Self-Generated Renewable Energy.

   Only a couple small scale self-generating renewable energy projects have been implemented at LLNL.

2. The LLNL Discovery [Visitor's] Center Photovoltaic (PV) Exhibit and installation of PV Parking Lot and Walkway Lighting at T1888/T1889 demonstrate and promote application of renewable power generation.

The small, demonstration scale, grid-connected, installation at the Discovery Center, has a maximum capacity of 10-kW, but has presently been built out only to 3.5-kW. The PV Exhibit has not been found to be life-cycle cost-effective. It was installed via DOE – Environmental Management funding for the purpose of promoting application of PV technology in the local community. During FY 2006, instrumentation indicates 3,855 kWh of power was generated. Based on the average cost of power at the Discovery Center, a direct PG&E account, cost savings totaled about $540.

3. The LLNL Environmental Remediation Department has deployed a number of Solar Treatment Units (STU's) throughout the main site and Site-300. The STU's are photovoltaic-powered, portable, groundwater contamination treatment units.

Widespread application of PV power at LLNL's main site and Site 300 is not presently cost effective due to the relatively high cost of PV power compared with the cost of wholesale power purchases.

LLNL has several smaller power supply contracts with PG&E, including the Visitor's Center and the MOCHO Pump Station. The Visitor's Center PV Exhibit described above has been installed on one of these accounts. The application of PV power at the remote MOCHO Pump Station and at the main site has been evaluated twice via Super – Energy Savings Performance Contract (ESPC) project Initial Proposals submitted to LLNL during FY 2005 and FY 2007. Analyses indicate installation of PV at LLNL is not life-cycle cost-effective.

## 5. New Projects

LLNL is planning to implement two ESPC measures, HVAC Controls & Electric Metering. Other energy savings action items have been identified and are in the process of implementation. Projects that have been selected for implementation include:

- Turn off CPUs when not needed. Change Laboratory-wide CPU backups and updates to accommodate sleep/hibernate modes.
- Virtual Computer Servers: fast-track conversion of Laboratory-wide computer servers to virtual servers.
- Chiller CHW water supply temperatures Lab-wide. Set building HVAC controls for unoccupied period temperature set-back / set-up.
- Set building HVAC controls for unoccupied period temperature set-back / set-up.
- Secure boilers during non-heating season.
- Assure lighting is turned off during unoccupied periods.
- Move Out of Office Trailers: move to permanent facilities; secure energy supplies to trailers.
- B132 N & S Lighting Retrofit: In-House Implementation.

We have been able to quantify the impact of the B132N Retrofit project and the HVAC controls project. Over the next few years, these projects would save 9,500 mWh annually. The results are summarized in Table 4-6.

## TABLE 4-6

### Lawrence Livermore National Laboratory
### New Projects

| Project | Completion Date | Total Project Cost ($, 000) | Annual Saving (mWh) | Annual Saving ($, 000) |
|---|---|---|---|---|
| B132N Re-Lamp Project | Sept. 2008 | 50 | 56.7 | $3.9 |
| Super-ESPC Project: HVAC Controls & Electric Metering | 2011 | 13,400 | 9,445 | 1,042 |
| **Total** | | 13,450 | 9,501.7 | $1,045.9 |

## 6. Impact of Conservation and Other Demand-Side Programs

Tables 4-7 and 4-8 show the impact of demand-side programs upon LLNL's demand and energy projections.

**Table 4-7**

**Lawrence Livermore National Laboratory**
**Demand Projections**
**(kW)**

| Fiscal Year | Base Case Projected Demand | Cumulative Estimated Savings | Net Demand Requirements |
|---|---|---|---|
| 2008 | 70,518 | 4,445 | 66,073 |
| 2009 | 72,517 | 4,445 | 68,072 |
| 2010 | 74,516 | 4,445 | 70,071 |
| 2011 | 74,516 | 4,445 | 70,071 |
| 2012 | 74,516 | 4,445 | 70,071 |
| 2013 | 74,516 | 4,445 | 70,071 |
| 2014 | 74,516 | 4,445 | 70,071 |

**Table 4-8**

**Lawrence Livermore National Laboratory**
**Energy Projections**
**(mWh)**

| Fiscal Year | Base Case Energy Projections | Cumulative Estimated Savings | Net Energy Requirements |
|---|---|---|---|
| 2008 | 444,997 | 17,888 | 427,109 |
| 2009 | 453,768 | 17,888 | 435,880 |
| 2010 | 461,089 | 17,888 | 443,201 |
| 2011 | 465,189 | 17,888 | 447,301 |
| 2012 | 465,189 | 17,888 | 447,301 |
| 2013 | 465,189 | 17,888 | 447,301 |
| 2014 | 465,189 | 17,888 | 447,301 |
| 2015 | 465,189 | 17,888 | 447,301 |

# SECTION 5

# SITE 300

## 1. Introduction

Site 300 is part of the National Nuclear Security Agency's (NNSA) complex at Livermore, California. Site 300 is located 15 miles southeast of the LLNL main site. The site is not connected electrically to the main LLNL facility. Western supplies electricity to Site 300 using the transmission grid controlled by the ISO. Site 300 shares in the Consortium's CVP entitlement and third party contracts purchased on DOE's behalf by Western.

Table 5-1 shows Site 300's actual demand and energy usage during the FY 2005 – FY 2007 period. Table 5-1 also shows Site 300's expenditures on electric energy during that time.

**Table 5-1**

**U. S. Department of Energy**
**Northern California Consortium**

**SITE 300**

| Data Summary | FY 2005 | FY 2006 | FY 2007 |
|---|---|---|---|
| Total Energy (mWh) * | 16,065 | 14,904 | 14,715 |
| Peak Demand (kW) | 3,060 | 2,928 | 2,598 |
| Electricity Expenditures | $766,075 | $708,508 | $771,144 |

* Total Energy (mWh) data is limited to electric power provided by Western for the federal fiscal years, commencing in October, each year.

## 2. Actual and Forecast Demands and Energy

Table 5-2 shows Site 300's actual demand and energy during the period 2004 – April 2008. (Table 5-2 shows estimated demand and energy data for the May – December 2008 period.) Table 5-3 shows Site 300's projected demand and energy during the 2009 – 2013 period.

**Table-5-2**

**U. S. Department of Energy**
**Northern California Consortium**

**SITE 300**
**Energy and Demand**
**Actual 2004 - 2008**

**Energy (mWh)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| January | 1,559 | 1,732 | 1,477 | 1,471 | 1,515 |
| February | 1,449 | 1,290 | 1,285 | 1,331 | 1,234 |
| March | 1,357 | 1,356 | 1,510 | 1,224 | 1,152 |
| April | 1,231 | 1,323 | 1,239 | 1,147 | 1,037 |
| May | 1,278 | 1,284 | 1,172 | 1,148 | 1,171 |
| June | 1,166 | 1,189 | 1,126 | 1,149 | 1,172 |
| July | 1,246 | 1,290 | 1,228 | 1,154 | 1,177 |
| August | 1,193 | 1,186 | 1,113 | 1,198 | 1,222 |
| September | 1,185 | 1,100 | 1,113 | 1,149 | 1,208 |
| October | 1,271 | 1,122 | 1,127 | 1,174 | 1,149 |
| November | 1,438 | 1,185 | 1,225 | 1,183 | 1,249 |
| December | 1,606 | 1,334 | 1,379 | 1,472 | 1,407 |
| **Total** | **15,981** | **15,390** | **14,994** | **14,801** | **14,695** |

**Demand (kW)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| January | 2,844 | 2,928 | 2,760 | 3,078 | 2,730 |
| February | 2,928 | 2,616 | 2,928 | 2,766 | 2,622 |
| March | 2,652 | 2,550 | 2,880 | 2,784 | 2,286 |
| April | 2,736 | 2,544 | 2,586 | 2,598 | 2,112 |
| May | 2,568 | 2,364 | 2,232 | 2,052 | 2,365 |
| June | 2,232 | 2,364 | 2,406 | 2,712 | 2,607 |
| July | 2,364 | 2,448 | 2,376 | 2,544 | 2,468 |
| August | 2,640 | 2,460 | 2,220 | 2,622 | 2,535 |
| September | 2,472 | 2,280 | 2,136 | 2,154 | 2,278 |
| October | 2,448 | 2,220 | 1,992 | 2,124 | 2,646 |
| November | 3,060 | 2,238 | 2,538 | 2,322 | 2,731 |
| December | 2,904 | 2,904 | 2,820 | 2,820 | 2,914 |
| **Total** | **31,848** | **29,916** | **29,874** | **30,576** | **30,295** |
| **Maximum** | **3,060** | **2,928** | **2,928** | **3,078** | **2,914** |

**Table 5-3**

**U. S. Department of Energy**
**Northern California Consortium**

**SITE 300**
**Energy and Demand Projections**
**2009 - 2013**

**Energy (mWh)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 1,516 | 1,531 | 1,531 | 1,531 | 1,531 |
| February | 1,371 | 1,385 | 1,385 | 1,385 | 1,385 |
| March | 1,261 | 1,273 | 1,273 | 1,273 | 1,273 |
| April | 1,182 | 1,194 | 1,194 | 1,194 | 1,194 |
| May | 1,183 | 1,195 | 1,195 | 1,195 | 1,195 |
| June | 1,184 | 1,196 | 1,196 | 1,196 | 1,196 |
| July | 1,189 | 1,201 | 1,201 | 1,201 | 1,201 |
| August | 1,234 | 1,247 | 1,247 | 1,247 | 1,247 |
| September | 1,220 | 1,232 | 1,232 | 1,232 | 1,232 |
| October | 1,161 | 1,172 | 1,172 | 1,172 | 1,172 |
| November | 1,262 | 1,274 | 1,274 | 1,274 | 1,274 |
| December | 1,421 | 1,435 | 1,435 | 1,435 | 1,435 |
| **Total** | **15,183** | **15,335** | **15,335** | **15,335** | **15,335** |

**Demand (kW)**

| Month | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| January | 2,954 | 2,966 | 2,966 | 2,966 | 2,966 |
| February | 2,953 | 2,979 | 2,979 | 2,979 | 2,979 |
| March | 2,833 | 2,850 | 2,850 | 2,850 | 2,850 |
| April | 2,790 | 2,826 | 2,826 | 2,826 | 2,826 |
| May | 2,368 | 2,372 | 2,372 | 2,372 | 2,372 |
| June | 2,632 | 2,656 | 2,656 | 2,656 | 2,656 |
| July | 2,464 | 2,459 | 2,459 | 2,459 | 2,459 |
| August | 2,531 | 2,526 | 2,526 | 2,526 | 2,526 |
| September | 2,277 | 2,277 | 2,277 | 2,277 | 2,277 |
| October | 2,684 | 2,722 | 2,722 | 2,722 | 2,722 |
| November | 2,775 | 2,819 | 2,819 | 2,819 | 2,819 |
| December | 2,933 | 2,953 | 2,953 | 2,953 | 2,953 |
| **Total** | **32,192** | **32,404** | **32,404** | **32,404** | **32,404** |
| **Maximum** | **2,954** | **2,979** | **2,979** | **2,979** | **2,979** |

## 3. Current DSM Projects

Table 5-4 shows the DSM projects currently in place at Site 300. A heating, ventilation and air conditioning (HVAC), direct digital controls (DDC) retrofit was completed at Site 300 during FY 2005, the first new energy efficiency/demand-side management project implemented since the FY 1999 IRP for Site 300.

**TABLE 5-4**

**U. S. Department of Energy**
**Northern California Consortium**

**SITE 300**
**FY 1998 Actual Project Summary Data**

| Project | Completion Date | Cost ($, 000) | Annual Savings (mWh) | Annual Savings ($, 000) |
|---|---|---|---|---|
| High Efficiency Lighting - Phase 5A | June1998 | 186 | 1,299 | 69.9 |
| HVAC – DDC Controls Retrofit – Various Buildings | Sept. 2005 | 275 | 1,570 | 80.9 |
| **Total by end of FY 2005** | | **$461** | **2,869** | **$150.8** |

Note: Dollar savings for these projects include electrical savings. Energy cost savings are updated with WAPA's electric power rates as of August 2006.

Renewable Energy Credits. Site 300 has also taken administrative actions to achieve energy reduction goals that include the purchase of renewable energy credits (RECs). LLNL commenced the purchase of RECs from Western with 576.7-mWh per year for five-years, starting in FY 2005. The purchase of RECs helps the laboratory achieve EO 13123 / DOE O 430.2A energy use reduction goals as a credit is allowed in reporting electric power use equal to that purchased as RECs. This REC credit is not available to help in achieving EPAct-2005 energy use reduction goals; rather, EPAct-2005 separately requires federal facilities to purchase renewable energy.

## 4. New Projects

Site 300 does not plan to implement any new demand-side programs over the next several years. Current programs bring Site 300's energy conservation efforts into compliance with EO 12423.

## 5. Impact of Demand-Side Program

The forecast of Site 300's future electric power requirements included in the 2004 IRP has been updated based on the most recent data available. Table 5-6 shows projections of the laboratory's demand requirements without the High Efficiency Lighting project and the reductions in demand requirements due to the implementation of the project, and actual and projected demand requirements net of these measures. Table 5-7 shows projections of the Laboratory's energy requirements without the High Efficiency Lighting project and the reductions in energy requirements due to the implementation of the project, and actual and projected energy need net of these measures.

**TABLE 5-5**

**U. S. Department of Energy**
**Northern California Consortium**

**SITE 300**
**DEMAND PROJECTIONS**
**(kW)**

| Fiscal Year | Base Case Projected Demand | Cumulative Estimated Savings | Net Demand Requirements |
|---|---|---|---|
| 2006 | 3,661 | 423 | 3,238 |
| 2007 | 3,757 | 423 | 3,334 |
| 2008 | 3,853 | 423 | 3,430 |
| 2009 | 3,949 | 423 | 3,526 |
| 2010 | 3,949 | 423 | 3,526 |
| 2011 | 3,949 | 423 | 3,526 |
| 2012 | 3,949 | 423 | 3,526 |
| 2013 | 3,949 | 423 | 3,526 |
| 2014 | 3,949 | 423 | 3,526 |
| 2015 | 3,949 | 423 | 3,526 |

**TABLE 5-6**

**U. S. Department of Energy**
**Northern California Consortium**

**SITE 300**
**ENERGY PROJECTIONS**
**(mWh)**

| Fiscal Year | Base Case Energy Projections | Cumulative Estimated Savings | Net Energy Requirements |
|---|---|---|---|
| 2006 | 21,459 | 3,734 | 17,725 |
| 2007 | 22,249 | 3,734 | 18,515 |
| 2008 | 23,333 | 3,734 | 19,599 |
| 2009 | 23,424 | 3,734 | 19,690 |
| 2010 | 23,424 | 3,734 | 19,690 |
| 2011 | 23,424 | 3,734 | 19,690 |
| 2012 | 23,424 | 3,734 | 19,690 |
| 2013 | 23,424 | 3,734 | 19,690 |
| 2014 | 23,424 | 3,734 | 19,690 |
| 2015 | 23,424 | 3,734 | 19,690 |

# SECTION 6

# STANFORD LINEAR ACCELERATOR CENTER

## 1. Introduction

The Stanford Linear Accelerator Center (SLAC) is a federally funded scientific research facility with major programs in photon science, high energy particle physics, and astrophysics. Located at Stanford University in Menlo Park, California, SLAC operates state of the art particle beam accelerators and related facilities for use in high-energy physics and synchrotron radiation research. The Linear Coherent Light Source (LCLS), which builds on the 2-mile linear accelerator, is currently under construction and will be the primary SLAC research facility in the coming decade.

SLAC receives all of its electricity under arrangements between DOE's Berkeley Site Office and Western. A portion of this power is from the Consortium's entitlement to CVP power marketed by Western. The balance of SLAC's resources is from a share of third party contracts Western secured acting as an agent for the Consortium. Power is delivered to SLAC over the transmission grid controlled by the California Independent System Operator (ISO). This section of the report focuses on SLAC's demand-side activities, since supply-side resources are secured under the auspices of the Berkeley Site Office acting on behalf of all of DOE's Northern California Laboratories.

The remainder of this section is organized as follows: Section 2 presents actual and forecasted demand and energy data. Section 3 reports the results of current demand-side conservation and energy efficiency measures in place at SLAC and their effect upon energy savings. Section 4 identifies demand-side measures to be considered to comply with DOE's requirements for reductions in energy usage in the future. The report also includes as an attachment a preliminary screening study undertaken on behalf of SLAC to identify the economic viability of various renewable energy alternatives.

## 2. Actual and Forecast Demands and Energy

SLAC's actual projected load data are in Tables 6-1 and 6-2 below. These projections are based on an anticipated scientific research program that is subject to change, depending on future funding levels.

**Table 6-1**

**U. S. Department of Energy**
**Northern California Consortium**
**Stanford Linear Accelerator Center**
**Actual Energy and Demand**
**2004 - 2008**

**Energy (mWh)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| January | 32,578 | 11,234 | 32,466 | 25,661 | 39,267 |
| February | 33,595 | 11,170 | 30,716 | 32,466 | 38,780 |
| March | 36,547 | 16,536 | 33,879 | 37,268 | 40,317 |
| April | 35,756 | 31,525 | 36,781 | 34,481 | 19,900 |
| May | 37,587 | 30,936 | 34,433 | 29,945 | 17,700 |
| June | 35,846 | 35,078 | 37,015 | 38,948 | 17,200 |
| July | 38,474 | 37,148 | 38,744 | 42,352 | 17,700 |
| August | 6,354 | 35,593 | 24,511 | 40,582 | 16,200 |
| September | 10,010 | 36,220 | 5,310 | 9,271 | 12,400 |
| October | 14,323 | 18,651 | 7,828 | 9,013 | 12,400 |
| November | 10,344 | 25,537 | 10,329 | 11,622 | 16,400 |
| December | 10,739 | 37,198 | 11,755 | 30,610 | 17,000 |
| **Total** | **302,152** | **326,826** | **303,766** | **342,219** | **265,263** |

**Demand (kW)**

| Month | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| January | 43,704 | 18,267 | 53,499 | 49,707 | 59,748 |
| February | 45,576 | 18,336 | 54,660 | 59,499 | 60,612 |
| March | 51,552 | 38,400 | 55,524 | 59,451 | 62,436 |
| April | 54,360 | 52,512 | 59,067 | 59,586 | 64,500 |
| May | 54,792 | 53,568 | 59,355 | 58,011 | 24,900 |
| June | 60,912 | 57,252 | 59,355 | 62,322 | 24,900 |
| July | 56,160 | 56,523 | 59,499 | 63,618 | 24,900 |
| August | 56,952 | 57,291 | 58,260 | 63,243 | 24,900 |
| September | 57,384 | 57,723 | 9,621 | 54,315 | 17,900 |
| October | 53,280 | 55,803 | 15,531 | 30,981 | 19,100 |
| November | 46,008 | 53,979 | 17,883 | 25,458 | 24,800 |
| December | 45,864 | 56,235 | 18,834 | 54,084 | 24,800 |
| **Total** | **626,544** | **575,889** | **521,088** | **640,275** | **433,496** |
| **Maximum** | **60,912** | **57,723** | **59,499** | **63,618** | **64,500** |

**Table 6-2**

**U. S. Department of Energy**
**Northern California Consortium**
**SLAC**
**Energy and Demand Projections**
**2009 - 2013**

| | | | Energy (mWh) | | |
|---|---|---|---|---|---|
| **Month** | **2009** | **2010** | **2011** | **2012** | **2013** |
| January | 17,000 | 20,000 | 24,000 | 24,000 | 24,000 |
| February | 15,500 | 18,700 | 23,200 | 23,200 | 23,200 |
| March | 17,100 | 20,600 | 25,700 | 25,700 | 25,700 |
| April | 19,500 | 24,900 | 24,900 | 24,900 | 24,900 |
| May | 20,100 | 25,700 | 20,600 | 20,600 | 20,600 |
| June | 19,500 | 20,000 | 20,000 | 20,000 | 20,000 |
| July | 20,100 | 20,600 | 20,600 | 20,600 | 20,600 |
| August | 11,200 | 11,600 | 11,600 | 11,600 | 11,600 |
| September | 10,900 | 11,200 | 11,200 | 11,200 | 11,200 |
| October | 19,000 | 19,000 | 19,000 | 19,000 | 19,000 |
| November | 19,400 | 19,400 | 19,400 | 19,400 | 19,400 |
| December | 19,000 | 19,000 | 19,000 | 19,000 | 19,000 |
| **Total** | **208,300** | **230,700** | **239,200** | **239,200** | **239,200** |
| | | | **Demand (kW)** | | |
| **Month** | **2009** | **2010** | **2011** | **2012** | **2013** |
| January | 24,800 | 29,900 | 38,500 | 38,500 | 38,500 |
| February | 24,900 | 29,900 | 38,500 | 38,500 | 38,500 |
| March | 24,800 | 29,900 | 38,500 | 38,500 | 38,500 |
| April | 29,900 | 38,500 | 38,500 | 38,500 | 38,500 |
| May | 29,800 | 38,500 | 29,900 | 29,900 | 29,900 |
| June | 29,900 | 29,900 | 29,900 | 29,900 | 29,900 |
| July | 29,800 | 29,900 | 29,900 | 29,900 | 29,900 |
| August | 15,600 | 16,200 | 16,200 | 16,200 | 16,200 |
| September | 15,700 | 16,200 | 16,200 | 16,200 | 16,200 |
| October | 29,700 | 29,700 | 29,700 | 29,700 | 29,700 |
| November | 29,900 | 29,900 | 29,900 | 29,900 | 29,900 |
| December | 29,900 | 29,900 | 29,900 | 29,900 | 29,900 |
| **Total** | **314,700** | **348,400** | **365,600** | **365,600** | **365,600** |
| **Maximum** | **29,900** | **38,500** | **38,500** | **38,500** | **38,500** |

### 3. Current DSM Energy Efficiency and Renewable Resource Projects.

Over the past several years, SLAC has undertaken numerous demand-side efficiency projects. Table 6-3 shows projects completed and in place through FY 2004. These projects provide 20,400 mWh of annual energy savings, with annual dollar savings amounting to $1.2 million. The cost of these projects was $6.0 million.

**Table 6-3**

**Actual Data for Projects Completed Prior to 2004**

| Project | Completion Date | Total Project Cost ($ 000) | Annual Savings | |
|---|---|---|---|---|
| | | | mWh | ($ 000) |
| Remote Monitoring & Control of Utility Systems for Linac | September 1998 | $2,140 | 8,475 | $428 |
| HV AC Direct Digital Control System – Phase 2 | May 1999 | $1,207 | 3,920 | $198 |
| Installation of programmable thermostats at packaged HVAC units | September 1999 | $23 | 63 | $3.2 |
| HV AC Direct Digital Control System – Phase 3 | September 2000 | $162.0 | 296 | $14.9 |
| Replacement of one Multi-Zone Air Handling unit (MZ-621) at Building 025 | October 2000 | $160 | 554 | $28 |
| Lighting Control with DDC EMS – Building 041, 1st Floor | June 2001 | $16.0 | 102 | $5.2 |
| Replacement of High-Bay Lighting at Building 026 | August 2001 | $29 | 141 | $7.1 |
| Lighting Control with DDC EMS – Building 041, 2nd Floor | May 2002 | $23 | 89 | $4.5 |
| Central Chilled Water Plant Upgrade | May 2002 | $1,390 | 2,316 | $117 |
| Klystron Gallery Lighting Upgrade - Phase 1 | September 2002 | $430.5 | 3,611 | $182.4 |
| Klystron Gallery Lighting Upgrade – Phase 2 | May 2003 | $125 | 845 | $42.7 |
| Computer Center DDC Energy Management System Upgrade | August 2003 | $69 | 250 | $12.6 |
| Accelerator Housing Lighting Control Modifications | May 2004 | $77.3 | 355 | $17.9 |
| Test Lab High-Bay Lighting Replacement | September 2004 | $35.6 | 155 | $7.6 |
| Low Conductivity Water systems decommissioning – North and South Focusing Magnets of SLAC Linear Collider (SLC) | June 2004 | $11.5 | 1,748 | $88.3 |
| Replacement of obsolete Variable Frequency Drives at 10 fan motors of SLAC Computer Center | July 2004 | $50.5 | 277 | $14.0 |
| Installation of Variable Frequency Drive at 125 HP fan motor of CT 1701 | August 2004 | $26.3 | 245 | $12.4 |
| Totals | | $5,976 | 20,442 | $1,184 |

More recently, over the past two fiscal years, SLAC has implemented additional energy-efficiency projects and is currently investigating ESPC third party financing for other energy conservation measures. Table 6-4 illustrates the projects SLAC completed during the period between FY 2006 and FY 2007[2]. The projects completed during this time cost $802,000 and reduced SLAC's usage by collectively contribute 1,252 mWh while saving.

Noteworthy energy conservation projects completed in FY06-07 include: (1) lighting efficiency upgrade projects for Building 084, Building 081, and Building 040 Central Lab, (2) HVAC upgrades to Building 025, (3) DDC Environmental Controls at B040 and B041, and (4) high efficiency pump motors at the B005 Cooling Tower. HVAC and lighting upgrades in the Main Control Center (Building 005) were completed in FY 2008.

**Table 6-4**

**Stanford Linear Accelerator Center**
**2006 and 2007 Energy Savings Projects**

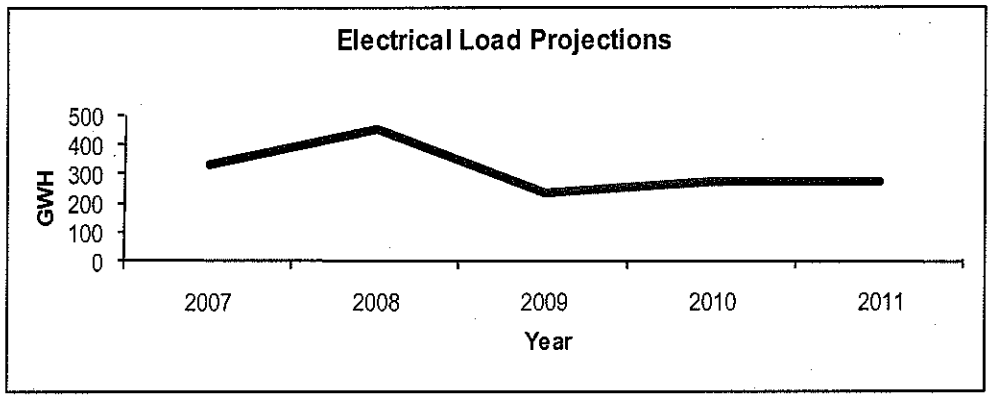
| Project | Completion Date | Cost ($000) | Annual Saving (mWh) | Annual Saving ($000) |
|---|---|---|---|---|
| Site Interior Lighting Upgrade – Phase 1 | Aug. 2006 | 260 | 276 | 14.9 |
| DDC EMS Upgrade | July 2006 | 86 | 200 | 10.8 |
| Replacement of Central Fans and Cooling Coils - Computer Center, B050 | July 2006 | 270 | 321 | 17.4 |
| Total | | 802 | 1,252 | 67.7 |

[2] No DSM projects were undertaken during FY 2005, because of an overall review of electric operation and maintenance practices.

## 4. Current Laboratory Goals and EO 13123 Impacts

SLAC has entered a period of transition, supporting both High-Energy Physics (HEP) and Basic Energy Sciences (BES) programs within the DOE's Office of Science. The PEP-II accelerator program ended in FY2008, resulting in a significant reduction in SLAC's total electrical load. The new Linear Coherent Light Source (LCLS) project is under construction and will lead to small gradual increases in electrical loads in the next few years, but not to the levels seen during the PEP-II era. Figure 6-4 illustrates future energy estimates.

**Figure 6-4**




Executive Order 13423 - Strengthening Federal Environmental, Energy, and Transportation Management supersedes EO 13123 and provides an improved alternative for federal agencies to manage energy toward specific goals. DOE has responded to this Executive Order with the TEAM Initiative. In response to these requirements, SLAC will put into place an executable pan, as required by the initiative, to help achieve the following goals:

1. 30 percent non-programmatic energy reduction by 2015
2. Water reductions of 16 percent by 2015
3. Renewable energy consumption levels >7.5 percent

4. All new construction >$5M will be LEED Gold Certified

5. 15 percent of facility building profile will be LEED Gold by 2015

These target goals, and others, will be contained within SLAC's executable plan. In addition to the executable plan, the current Performance Evaluation Measurement Plan (PEMP) contains goals linked to the TEAM Initiative and reflects the targets established by EO 13423.

In addition to the DOE compliance goals and objectives, SLAC is initiating an Infrastructure Modernization Proposal which will change the complexion of the facilities to more adequately support the culture and vision of the laboratory. The plan includes the addition of a new research building (56k square feet), modernization of three existing buildings (65k square feet), the demolition of substandard trailers (57k square feet) and the addition of a new computer center. These improvements will help SLAC gain efficiencies in energy management as the buildings will be LEED Certified and replace inefficient legacy systems.

## 5. Projected DSM / Energy Efficiency / Renewable Resource Projects

Several energy conservation measures (ECM) are currently being studied or are in various stages of implementation. Among these are:

- Improving process cooling water distribution system efficiencies
- Adding an advanced metering system that can be used for energy management
- Upgrading HVAC equipment and controls systems to improve efficiency
- Upgrading lighting systems to improve efficiency

Currently, SLAC is proceeding with the conceptual design and cost estimate of a new advanced power monitoring system in accordance with DOE O 430.2B. The plan was complete and submitted to the DOE in FY2007. When installed, this system will provide SLAC with data required to make informed decisions in energy management. The estimated savings resulting from the installation of advanced meters is between

2 and 3 percent. This is a number accepted by the DOE and is derived from the implied results of the Hawthorne Effect.

Additionally, SLAC began its evaluation of energy service companies (ESCOs) in 2007 in conformance with the DOE TEAM Initiatives and the DOE FEMP Super Energy Savings Performance Contracting process. A steering committee was formed to review the pre-approved ESCOs and a selection process was initiated. NORESCO, an energy services company with western regional headquarters in Irvine, CA, was given direction to develop an initial proposal which was presented to SLAC in February 2008. General site-wide energy surveys have been completed and an informal report of findings was produced with twelve proposed energy conservation measure projects. Each of the ECMs in this initial proposal is currently being reviewed for its potential benefits.

A comprehensive listing of the DSM conservation measures that were proposed and are under consideration are described below. SLAC is in the process of moving forward with a limited detailed energy survey intended to evaluate selected projects within the proposed ECM listing. The selected Super ESPC delivery order project design and construction activities are tentatively scheduled to commence in FY2009.

ECM 01 – Lighting Upgrade ($2.37M): Replace existing fluorescent and HID fixtures with T-8 high efficiency lighting. This ECM will include 72 buildings and has an estimated annual savings return of 5.85 gWh - $361,268.

ECM 02 – Water Conservation ($322k): Replace existing water fixtures, site wide, with high efficiency ultra low flow devices. This ECM will save an estimated 3,595 kgal of water and 679 therms of natural gas annually. - $27,510.

ECM 03 – Advanced Metering ($828k): Metering of electricity, water and natural gas for non-process support buildings that fall within the metering guidelines published by FEMP (31 buildings total). A 2.5 percent reduction of service loads is estimated for each commodity - $65,870.

ECM 04 – Boiler Combustion Controls and VFDs ($287k): Replace obsolete linkage style controls with digital controls connected to automated logic control system for enhanced fuel flow, air flow, stack temp, and energy use. This ECM will reduce

electrical load by an estimated 207,935 kWh and natural gas load by 19,179 therms - $28,691.

ECM 05 – Chilled Water Flow Control and Plant Modifications ($498k): Replace existing chilled water control valves with flow limited two-way valves minimizing supply dilution and enhancing secondary loop efficiency. This ECM includes replacing an estimated 178 valves and has been estimated to save 507,437 kWh of electrical energy - $30,905.

ECM 06 – Solar Photovoltaic System (cost unknown): Install a nominal 1MW solar array on the klystron gallery roof paid for through an energy services agreement. This system could help SLAC add approximately 1 percent to the on-site renewable energy requirements of the TEAM Initiative while saving an estimated annual 1.5 gWh.

ECM 07 – Variable Speed Cooling Tower Fans ($475k): Replace existing constant speed and three speed fans in six major cooling towers with VFDs and VFD compatible motors. This ECM will save an estimated 1.04 GWh of electrical energy - $63,292.

ECM 08 – Variable Speed Cooling Tower Pumps ($2.5M): Add new VFDs and VFD compatible motors and control components to seven cooling tower water distribution systems. This ECM will save an estimated 5.18 GWh of electrical energy - $315,300.

ECM 09 – Low Conductivity Water Pumping ($1.3M): Install VFD's, VFD compatible motors, and system control features capable of limiting flow rates to required levels in areas where needed and reducing the flow rates in accelerator systems not currently in use. This ECM has an estimated savings of electrical power in the 5.85 gWh range - $355,980.

ECM 10 – B118 Chiller Replacement ($385k): Replace inefficient aged chiller and reconfigure the control systems to optimize load capacity. This ECM has an estimated potential savings of 153,898 kWh of electricity - $9,372.

ECM 11 – Recommission HVAC Controls ($3.6M): Review and readjust all digital control system algorithms, sensors, devices and repair or replace as necessary any broken or defective control components. Duct sealing will be evaluated for potential

savings during the detailed energy survey phase of this ECM. The total estimated energy savings includes 1.57 GWh of electricity and 16,781 therms excluding any duct sealing estimates which could increase the estimated 3.5 percent savings substantially reducing ROI term - $109,847.

ECM 12 – Duct Sealing (Unknown): Duct sealing will be evaluated for implementation during the detailed energy survey consistent with those guidelines established at the Lawrence Berkeley National Lab. Initial studies at LBNL reveal a potential for 30 percent reduction in fan speed and 65 percent reduction in fan power requirements on buildings with > 10 percent duct leakage. Leakage evaluations are to be performed in the detailed energy survey.

These proposed ECMs above are summarized in Table 6-5.

**Table 6-5**

**ESPC Project Initial Proposal ECM Listing**

| No. | Description | electrical energy kWh/yr | natural gas therms/yr | Water kgal/yr | Sewer kgal/yr | Maint Savings | Annual Savings |
|---|---|---|---|---|---|---|---|
| ECM 001 | **Lighting** > | 5,850,042 | | | | 5,000 > | $361,268 |
| ECM 002 | **Water Conservation** > | | 679 | 3,595 | 3,595 | > | $27,510 |
| ECM 003 | **Advanced Metering** > | 943,821 | 9,589 | 113 | | > | $65,870 |
| ECM 004 | **Boiler Combustion Controls** > | 207,935 | 19,179 | | | > | $28,691 |
| ECM 005 | **CHW Flow Control/Plant Mods** > | 507,473 | | | | > | $30,905 |
| ECM 006 | Photovoltaic Power > | 1,481,667 | | | | > | $90,234 |
| ECM 007 | **CT Fans** > | 1,039,275 | | | | > | $63,292 |
| ECM 008 | **CTW Pumping** > | 5,177,344 | | | | > | $315,300 |
| ECM 009 | **LCW Pumping** > | 5,845,315 | | | | > | $355,980 |
| ECM 010 | **B118 Chiller Replacement** > | 153,898 | | | | > | $9,372 |
| ECM 011 | **Controls Tune/HVAC mods** > | 1,573,457 | 16,781 | | | > | $109,847 |
| ECM 012 | Repair Leaking HWS piping > | | 14,940 | 1,062 | | > | $15,682 |
| | ***totals*** > | 21,298,560 | 46,229 | 3,708 | 3,595 | 5,000 > | $1,368,035 |

Note: The annual cost savings are calculated based upon projections of electrical rates with estimated escalation factors.

Additional Studies, Reports, and Other Analyses. In response to the Department of Energy Order 430.2B, SLAC conducted its evaluation of third party financing alternatives for energy reduction projects and selected NORESCO to submit an initial ESPC proposal. This proposal was initiated in late FY 2007 and received from

NORESCO in March of 2008. The initial proposal includes a high level site wide survey of the energy consuming systems, an analysis of these systems, and a list of proposed conservation measures and the estimated potential energy savings. Included in the initial submittal are twelve energy conservation measures for consideration and an analysis of SLAC's energy consumption on a programmatic versus non-programmatic basis. SLAC is currently reviewing the proposal and will move forward with those measures that are judged to be cost effective and compatible with other institutional plans and requirements.

Renewable Energy Evaluations. In addition to the Super ESPC initial proposal report, a detailed engineering evaluation by Antares Engineers and Economists released in May 2008 provides a renewable energy site assessment for SLAC. The executive summary of this report is attached.

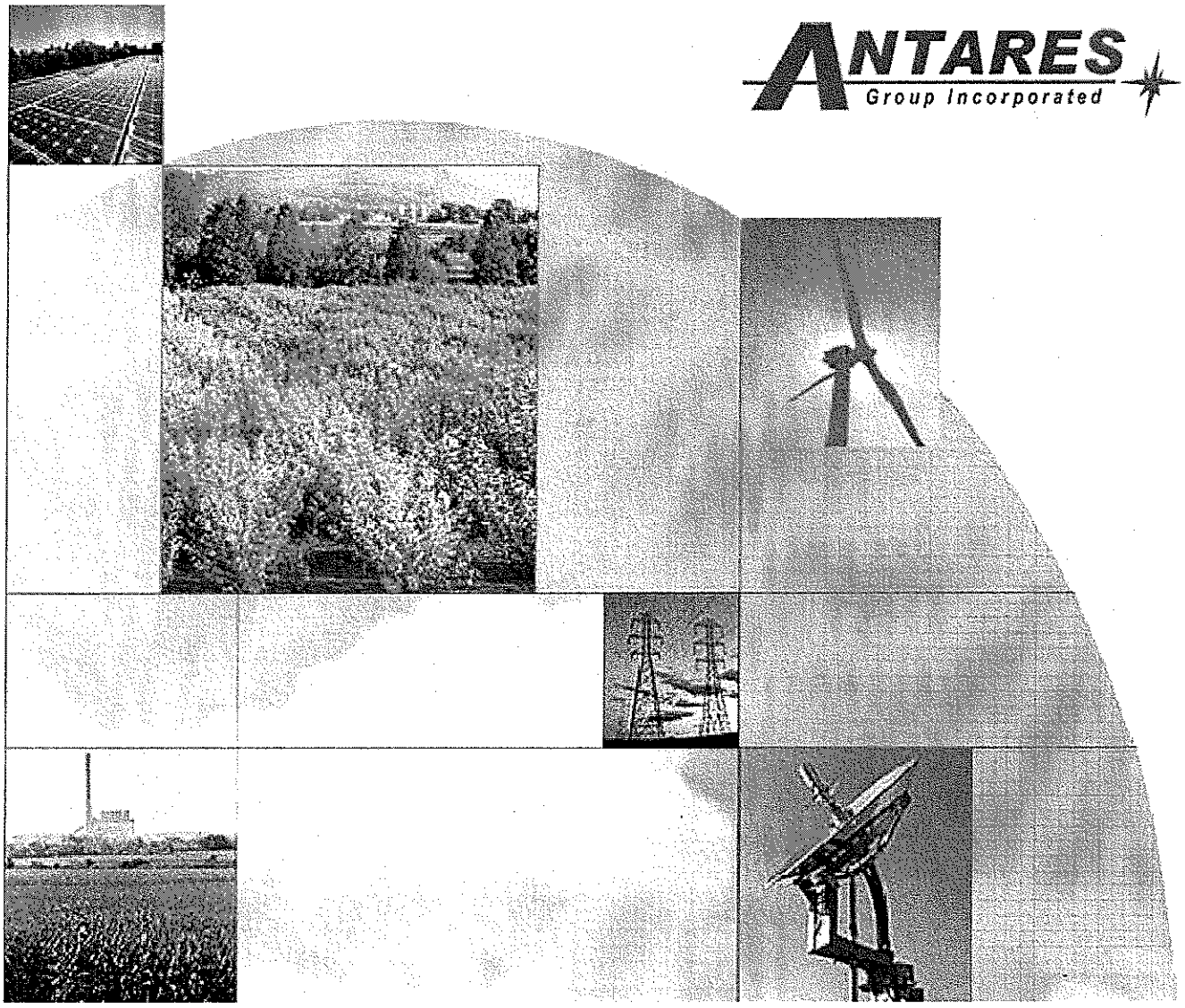
In 2006 a lighting survey was conducted at SLAC for buildings 005, 026, 061, 062, 081, 120 and 131. The purpose of the audit was to gain information on the existing lighting systems, recommend new enhanced efficiency lighting system components, and then calculate estimated savings in light and thermal energy as a result of the proposed installation. This study and others were provided to NORESCO and incorporated into the initial proposal activities and presentation package.

# ATTACHMENT TO SECTION 6

## Stanford Linear Accelerator Center (SLAC)

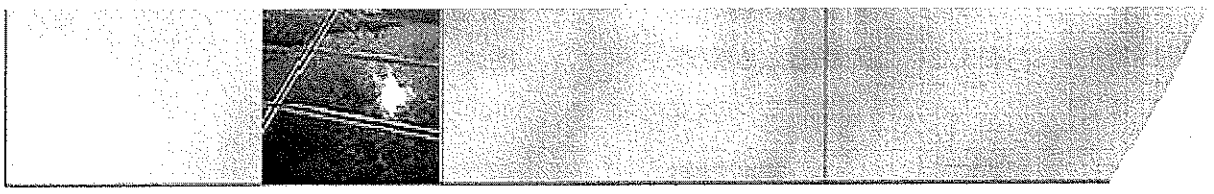
## Antares Renewable Energy Site Assessment

## (May 2008)



# Stanford Linear Accelerator Center Renewable Energy Site Assessment Draft Report

| | |
|---|---|
| ***Contract Reference:*** | ***20.007.01*** |
| ***Prepared by:*** | ***ANTARES Group Inc.*** |
| ***Prepared for:*** | ***U.S. Department of Energy*** |
| ***Date:*** | ***May 23, 2008*** |



EXECUTIVE SUMMARY

As part of the Transformational Energy Action Management (TEAM) Initiative, DOE FEMP requested technical assistance to perform an assessment of on-site renewable energy opportunities at Stanford Linear Accelerator Center in Menlo Park, CA. This assessment includes an analysis of potential opportunities for several renewable energy technologies, including: solar photovoltaics, solar thermal, active daylighting, wind turbines, and biomass energy projects.

Antares staff performed a site visit on April 9, 2008. The primary purpose of the site visit was to gather the necessary data to perform economic and technical analyses for potential on-site renewable energy installations.

The report considers options for financing, potential project sizes, and various technologies to determine which cases, if any, will be economically justifiable over a 25 year period. Sensitivities to the availability of various incentives and RECs are also explored in this study. The result of the renewable energy analyses conducted for the site indicate the following:

- SOLAR PV - Several potential sites for PV development were identified. These sites included roof top and ground mounted locations. Solar PV lighting options are also discussed. The resulting economic analyses suggest that none of the projects reviewed would result in energy savings at the site on a life-cycle cost basis. However, a ground mounted Concentrating PV (CPV) project could have acceptable simple payback period (i.e. no discounting factor) under 25 years.

- DAYLIGHTING - An active solar daylighting installation was analyzed for the Klystron Gallery, as it is a large area with constant lighting loads. This analysis suggests that this application would have a long but potentially acceptable payback period.

- SOLAR THERMAL - The only solar thermal project that was investigated for SLAC was a solar hot water system at the cafeteria, as there are no other buildings with significant hot water loads and air-preheating technologies do not apply in this climate. This analysis suggests that solar hot water heating for the cafeteria building has a long, but potentially acceptable payback period.

- WIND ENERGY PROJECTS - There is little potential to develop a commercially significant or economically justifiable wind project at SLAC. Windspeed data available from the Stanford Wind Energy Project (SWEP) was used to estimate wind energy potentials. These data suggest that average wind velocities are far too low for a wind energy project to be feasible.

- BIOMASS ENERGY - There does not seem to be much potential to develop a biomass energy facility on site. SLAC is located in a non-attainment area, which would be a very large barrier for permitting. Additionally, there is not enough available area near the central boiler facility to support the storage and handling of biomass that would be required for a biomass energy project.

A summary of the life cycle cost analysis for considered PV technologies based on an ESPC or PPA agreement with a 25 year term is shown in Exhibit 1 below. Analysis results for the active daylighting system and cafeteria solar hot water system are given in Exhibit 2 and Exhibit 3, respectively.

Project lifetime, PPA contract lifetime (through WAPA), and ESPC contract lifetimes in these analyses are all assumed to be 25 years. The lifecycle costs for the renewable energy systems are compared with the cost of purchasing energy for 25 years (status quo) in the tables. The analysis results for PV systems depend on selling / swapping solar RECs, for a value of $0.06/kWh. It is also assumed that the site will receive the double bonus for renewable energy production on-site, as described in the FEMP Guidance document (US Department of Energy FEMP 2007).

Estimated electricity production and current and constant levelized costs of electricity (LCOE) for the PV systems are shown in Exhibit 1. For comparison, SLAC's FY 2008 annual electricity consumption was 247.9 GWh. The on-site electricity is provided by WAPA, and currently costs $0.059/kWh but is projected to cost $0.079 in 2009.[3]

Based on this analysis, there is potential for installing new renewable energy generation via photovoltaic, active daylighting, solar thermal systems at SLAC. A 25 year PPA agreement has the best results for all cases. However, if the ESCo bundled smaller renewable energy project with other energy conservation measures (ECMs), it may improve overall economic viability.

The systems with the lowest payback periods are the ground-mount Concentrating PV system south of the Klystron Gallery ("the Gallery"), active daylighting installation at the Gallery, and a Solar Hot Water system at the Cafeteria.

The 1 MW CPV system in the open area south of the Klystron Gallery would generate about 1.5 GWh of electricity annually, for a constant levelized cost of $0.11/kWh (for PPA financing with incentives and RECs). Although generating PV power at such rates is very reasonable, the low cost of WAPA power does present a challenge. At the production cost level, the PV array would generate electricity at $0.05/kWh more than the current price for WAPA electricity, or $0.03/kWh more than the projected 2009 electricity cost. Although this disparity is projected to be erased in out years, the parity comes too late to rescue the LCC economics. Over the 25-year lifetime, the CPV system would cost $1.3 million dollars more than status quo.

That said, the reviewed project is relatively large and the resulting economics could be attractive if different contract or market mechanisms could be identified that further enhance the results. This may include reviewing alternate project structures and different approaches to value the RECs. The project could also be scaled up to offset more of the grid-tied energy consumption on-site.

It is important to note that the PV economic results are based on installed cost estimates from Antares in-house resources and recent vendor quotes, and are somewhat higher than the installed costs used by NREL in DOE site assessments. For comparative purposes, an alternate economic analysis for these PV systems has been performed using installed costs based the NREL values. These results are given in Appendix A.

[3] Projected cost is weighted for peak and off-peak electricity costs from Exeter analysis, as appropriate for solar projects that operate during daylight hours.

**Exhibit 1 Life Cycle Cost Analysis Results - PV Systems**

| | | Roof Mounted PV | Klystron Gallery (thin film) | Ground Mount PV | Ground Mount CPV |
|---|---|---|---|---|---|
| | Electricity Production (MWh/yr) | 368.1 | 989.1 | 1,890 | 1,506 |
| | Installed Capital Cost ($000) (1) | $2,354 | $5,940 | $1 1 ,500 | $5,500 |
| | 2009 Electricity Cost ($/kWh) | $0.079 | $0.079 | $0.079 | $0.079 |
| | Year 1 Energy Savings ($000) | $29.16 | $78.36 | $149.7 | $119.3 |
| | 25 Year Status Quo LCC ($000) (2) | $523.4 | $1,406 | $2,688 | $2,141 |
| **All Incentives and RECs** | | | | | |
| | 1st Yr Undiscounted Savings ($000) (3) | $69.33 | $186.95 | $336.30 | $261.45 |
| **ESPC (25 years)** | System LCC ($000) | $1,650 | $3,850 | $7,637 | $3,439 |
| | Current $ LCOE | $0.35 | $0.31 | $0.32 | $0.19 |
| | Constant $ LCOE | $0.29 | $0.25 | $0.26 | $0.16 |
| | Simple Payback | 43 years | 37 years | 39 years | 24 years |
| **PPA (25 years)** | System LCC($000) | $1,683 | $3,943 | $7,859 | $3,487 |
| | Current $ LCOE | $0.26 | $0.23 | $0.24 | $0.13 |
| | Constant $ LCOE | $0.22 | $0.19 | $0.20 | $0.11 |
| | Simple Payback | 37 years | 27 years | 28 years | 19 years |

(1) The installed capital cost is the base system cost and does not include incentives or ESPC markup.

(2) Status Quo Life Cycle Cost (LCC) is the cost of purchasing electricity over 25-year period

(3) Sum of energy savings, Incentive and RECs, and O&M cost for first year. Doesn't include debt payment.

**Exhibit 2 Life Cycle Cost Analysis Results - Active Daylighting System**

| | | **Klystron Gallery** |
|---|---|---|
| | Electricity Savings (MWh/yr) | 704.4 |
| | Installed Capital Cost ($000) (1) | $1,331 |
| | 2009 Electricity Cost ($/kWh) | $0.079 |
| | Year 1 Energy Savings ($000) | $55.80 |
| | 25 Year Status Quo LCC ($000) (2) | $1,001.6 |
| **No Incentives** | | |
| | 1st Yr Undiscounted Savings ($000) (3) | $66.96 |
| **ESPC (25 years)** | System LCC ($000) | $1,336.9 |
| | Simple Payback | 21 years |
| **PPA (25 years)** | System LCC ($000) | $1,434.7 |
| | Simple Payback | 18 years |

(1) The installed capital cost is the base system cost and does not include incentives or ESPC markup.

(2) Status Quo Life Cycle Cost (LCC) is the cost of purchasing electricity over 25-year period

(3) Sum of energy savings, and O&M savings for first year. Doesn't include debt payment.

## Exhibit 3 Life Cycle Cost Analysis Results - Solar Thermal System

| | Cafeteria Solar Hot Water (37° tilt) (1) | Cafeteria Solar Hot Water (90° tilt) (1) |
|---|---|---|
| Energy Savings (MMBtu/yr) | 129 | 96 |
| Installed Capital Cost (2) | $24,000 | $24,000 |
| Current Natural Gas Cost ($/MMBtu) | $7.33 | $7.33 |
| Year 1 Energy Savings 1st Yr | $1,182 | $880 |
| Undiscounted Savings (3) | $638 | $760 |
| 25 Year Status Quo LCC (4) | $24,851 | $18,494 |
| **All Incentives** | | |
| System LCC | $22,283 | $22,577 |
| Simple Payback | 16 years | 21 years |

(1) The Cafeteria SHW systems are equivalent except for the mounting tilt angle to the roof (0° is horizontal, 90° is vertical).

(2) The installed capital cost is the base system cost and does not include incentives or ESPC markup.

(3) Sum of energy savings, incentives, and O&M cost for first year. Doesn't include debt payment.

(4) Status Quo Life Cycle Cost (LCC) is the cost of purchasing natural gas over 25-year period.

# SECTION 7

# NEVADA TEST SITE

## 1. Introduction

The Nevada Test Site (NTS or Site) is located 65 miles northeast of Las Vegas, Nevada. NTS currently receives most of its power from the Nevada Power Company (NPC) under the utility's LGS-Transmission rate schedule. In addition to the NPC power, the Valley Electric Association (Valley or VEA), wheels approximately 2 MW of Western power to the Site under terms and conditions specified in a wheeling agreement between VEA and NTS. VEA interconnects with the government-owned NTS loop at the Jackass Flats Substation through a Valley-owned line running from its Pahrump Substation. NTS is interconnected with NPC at the Mercury Switching Center through a line from the Company's Northwest Substation. An NPC-owned line connects the Jackass Flats Substation to the Mercury Switching Center, establishing a Valley/NPC interconnection.

## 2. Projected Demands and Energy

Tables 7-1 and 7-2 show NTS' projected demand and energy for the next five years, from FY2009 through FY2013.

**Table 7-1**

**Nevada Test Site**
**Demand Projections (kW)**
**FY09-FY13**

| Fiscal Year | Base Case Projected Demand | Cumulative Estimated Savings | Net Demand Requirements |
|---|---|---|---|
| 2009 | 36,180 | 180 | 36,000 |
| 2010 | 59,180 | 180 | 59,000 |
| 2011 | 60,180 | 180 | 60,000 |
| 2012 | 60,180 | 180 | 60,000 |

| Table 7-2<br>Nevada Test Site<br>Energy Projections (mWh)<br>FY09-FY13 | | | |
|---|---|---|---|
| Fiscal Year | Base Case Energy Projections | Cumulative Estimated Savings | Net Energy Requirements |
| 2009 | 207,151 | 1,598 | 205,553 |
| 2010 | 207,151 | 1,598 | 205,553 |
| 2011 | 336,075 | 1,598 | 335,377 |
| 2012 | 342,385 | 1,598 | 340,786 |
| 2013 | 342,384 | 1,598 | 340,786 |

In the 1997 Integrated Resource Plan (IRP), NTS set 5- and 10-year goals for electric power usage based on meeting the requirements of the Energy Power Act and Executive Order 12902. The Site has since amended its goals to meet the new requirements of Executive Order 13123, which was issued in June 1999. The goals now include reductions in the Site's total energy usage per square foot by 20 percent by FY 2005 and 25 percent by FY 2010, relative to a FY 1990 baseline. During FY 2001, National Security Technologies (NSTec) reported a 52.9 percent decrease in BTUs per square foot compared to FY 1985. This exceeds the 25 percent reduction goal set for FY 2010 by Executive Order 13123.

### 3. Current Demand-Side Programs

During the 1997-2003 period, NTS implemented several demand-side measures. These are summarized in Table 7-3.

**TABLE 7-3**

**Nevada Test Site**
**FY 1997 through 2003 Actual Project Summary Data**

| Project | Completion Date | Total Project Cost ($000) | Annual Savings (mWh) | Annual Savings ($000) |
|---|---|---|---|---|
| HVAC Upgrades - Bldg. 23-725 | Jul. 1997 | 184 | 810 | 47 |
| **Total FY 1997** | | **$184** | **810** | **$47** |
| Lighting Retrofit - Remote Sensing Lab | Sep. 1998 | 234 | 588 | 38 |
| **Total FY 1998** | | **$234** | **588** | **$38** |
| Power Metering Project | Aug. 1999 | 869 | - | - |
| Photovoltaic Heat Trace System* | Sep. 1999 | 8 | 0.05 | 6 |
| **Total FY 1999** | | **$877** | **0.05** | **$6** |
| Programmable Thermostats[1] | May 2000 | 100 | 200 | 12 |
| **Total FY 2000** | | **$100** | **200** | **$12** |
| **Total Energy Savings Projects Since FY 2001** | | **$1,395** | **1,598** | **$103** |

* These are life-cycle costs, not just energy savings.

No new programs were implemented during 2005 and 2006.

## 4. Projected DSM/Energy Efficiency Projects

There currently are initiatives and projects being proposed to assist the NTS in meeting its future energy requirements using various energy conservation measures and new renewable resources. Some of these projects are briefly described below:

Proposed Renewable Resource Project- Concentrating Solar Power (CSP) Plant. Solar electricity would be provided to the NTS by the building of a new Concentrating Solar Power (CSP) plant within the existing Solar Enterprise Zone at the NTS through Johnson Controls and partners. The use of this renewable energy would eliminate the purchase of a significant portion of NTS's most expensive on-peak utility power.

Johnson Controls would supply a 9 MW block of CSP electricity as a performance period service to NTS daily under an Energy Services Agreement.

Proposed Energy Conservation Measures (ECMs). A proposal for various ECMs is being developed for over 30 buildings located at the NTS. This proposal identifies implementation costs and potential energy and operational savings for these facilities. A preliminary list of these proposed ECMs are as follows:

- Boiler Replacement
- Building Controls Installation
- Pump Variable Frequency Drives (VFD) Installation
- Air side Economizer Installations
- Variable Air Volume (VAV) Retrofits
- Lighting Retrofits
- Lighting Controls
- Meter Installation
- Install Economizer Cycle
- Window Film

## 5. Energy Goals

NTS' long-term goals are designed to meet the requirements of Executive Order 13123. The goals now include reductions in the Site's total energy usage per square foot by 20 percent by FY 2005 and 25 percent by FY 2010, relative to a FY 1990 baseline. During FY 2001, National Security Technologies (NSTec) reported a 52.9 percent decrease in BTUs per square foot compared to FY 1985. This exceeds the 25 percent reduction goal set for FY 2010 by Executive Order 13123.

Since the time the 2004 IRP was prepared, there have been no changes to the previously reported projects and no new projects are planned for the Site. In all, the projects implemented from FY 1997 through FY 2004 are annually saving the Site 1,598 mWh and $103,000. These are identified in Table 7-3.